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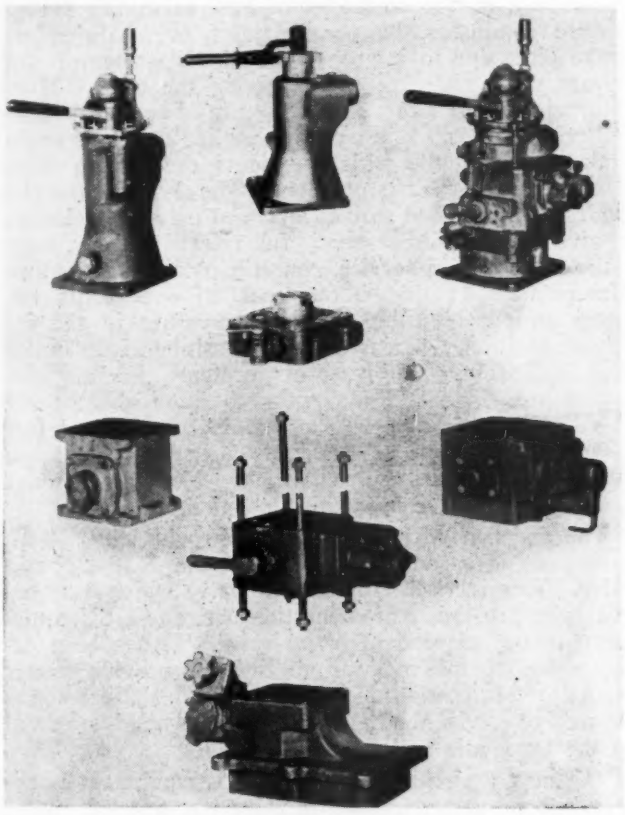
Developments in Car and Locomotive

Brakes and Control Equipment*

By A. S. Benton†

Progress made during war in engineering improvements for new and old railway equipment—Required changes made to meet lightweight and high speeds

We are at the threshold of a new era in transportation, particularly in railroad transportation. The railroads and the equipment builders have not been idle during the war period even though their facilities were, in most cases, devoted for long periods exclusively to standardized production for war transportation. New and more easily controlled Diesel locomotives have been introduced. Improved steam locomotives of greater power and efficiency have been built and placed in operation. A number of new freight car designs have been produced, in small quantities to be sure, so far, but offering the advantages of lighter weight, less maintenance, and greater suitability for high-speed service. Passenger cars likewise have been undergoing equal development, pointing toward greater convenience, comfort, speed and attractiveness from the passenger's viewpoint, although their actual production was halted.



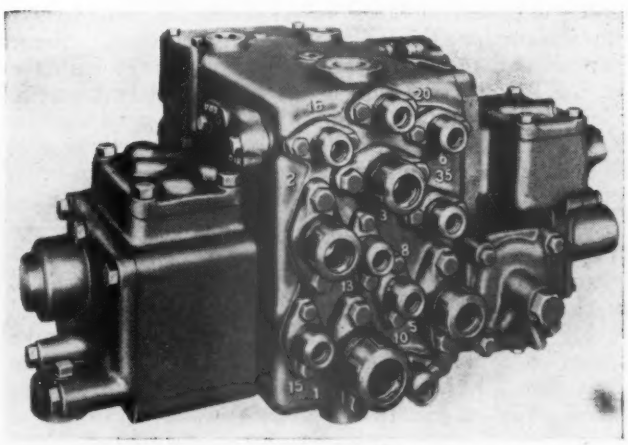
Top to bottom: Left—Brake valve portion and application portion (emergency); Center—Brake valve portion (rigid handle; rotary valve and seat (same for all); filling piece portion (same for all); pipe bracket portion; Right—Brake valve portion (for pneumatic straight air); application portion (service)

The D-24 brake valve portions

With this advancement in equipment, the matter of control becomes more and more important, particularly as train speed increases. The air brake is a relatively small item, but is very important in this control. The designer of air brake equipment must be constantly adjusting his thinking to match the trend in the development of railroad transportation. Equipment changes are not offered just to be new, but are developed to properly meet new problems presented because of changed operating conditions, new demands made on the equipment, etc. A typical example of this is the need which caused us to develop and just recently introduce the No. 24-RL locomotive brake equipment.

Locomotive Controls

Earlier locomotive brake equipment rather naturally developed into two types to meet two general classes of service. The two types of equipment and the two classes of service are the No. 8-ET locomotive brake equipment



Back of the D-24 control valve

* A paper delivered before the Southern and Southwestern Railway Club at Atlanta, Ga., on May 17, 1945.

† District representative, Westinghouse Air Brake Co., Atlanta, Ga.

D-1 controller

which was particularly developed for conventional speed passenger trains and long heavy freight trains, and the HSC equipment especially designed to include such features as electropneumatic control, speed governor control, etc., associated with the relatively new high-speed passenger service employing streamlined cars.

These locomotive brake equipments were developed at two different time intervals and for rather specific purposes. While they are quite satisfactory for their particular fields they do not lend themselves conveniently to being converted from one type of service to the other. In addition, they, of course, involve maintenance of two distinct types of equipment. As a result there developed an insistent demand that a single type of locomotive brake equipment be offered which would provide the basic requirement for heavy freight and conventional passenger service, and at the same time readily permit incorporation of all additional features required for the high-speed train service. The incorporation of the additional features desired had to be accomplished without discarding any of the basic features or change in the basic piping, by merely adding the required functional apparatus. This has been accomplished, and as a result we have the No. 24-RL type of locomotive brake equipment. The new items of major importance in this equipment are the D-24 brake valve including the S-40-D self-lapping independent brake valve, the D-24 control valve with its combined auxiliary and displacement volume reservoir and the relay valve. This compares with the No. 8-ET equipment which has the No. 8 brake valve including the automatic and independent portions, the No. 8 distributing valve with its reservoir portions, and the brake-pipe vent valve.

The brake valves shown in one of the illustrations are intended for Diesel locomotive service. The D-24 brake valve for steam locomotives is similar, except for the style of handle and the top portion employed. The D-24 brake valve is the simplest or basic form that would provide safety control features with emergency brake application for Diesel engine use. The DS-24 brake valve offers all of the features of the basic valve, and by changing the application portion only it provides a service type of brake application for safety control, overspeed control, or train control application. The DSA-24 brake valve incorporates the features of the others, and by changing only the body portion, the straight-air feature required for electro-pneumatic control is provided. Many of the parts of these three brake valves are common to all and, therefore, the problem of maintenance, testing, etc., is greatly simplified.

Improved Feed Valve

In designing the D-24 brake valve a special effort was made to include any new features or improvements that seemed desirable. As a result, we have the new D-24 feed valve. This feed valve has materially increased the flow capacity and is also much more sensitive to air demands, so that it will regulate pressure within a considerably narrower range than any previous feed valves. Its design is such that the maintenance required should be less and should also be more easily accomplished than with previous feed valves. The greatly increased capacity of the D-24 feed valve enables us to offer for the first time, a controlled-pressure full-release position in the brake valve. This greatly increased feed-valve flow capacity makes possible the charging of long trains as rapidly as when using the main reservoir pressure full-release type of brake valve.

The use of the controlled-or-feed valve full release feature eliminates the possibility of overcharging the brake pipe, due to improper use of main-reservoir full release when charging or recharging the train. Many railroads already either forbid the use of main-reservoir-full-release by rule or they have applied nullifiers to the brake valve handle which prevents the handle being moved to full-release position. The brake valve includes a cutout cock so that any who may feel reluctant to give up the main reservoir full release entirely, especially in mountain service, can still obtain that feature. Manipulation of this cutout cock to one of its two positions, provides the controlled pressure in the full release position, whereas the other position of the cutout cock substitutes main-reservoir pressure for the controlled pressure in the full release position of the brake valve. With the brake valve in running position, the feed valve delivery to the brake pipe is choked to provide the same capacity as it obtained with the No. 8 brake valve and M-3 feed valve in running position.

The independent brake operation with the 24-RL equipment is accomplished through the S-40-D brake valve. This is a self-lapping type valve which has been in service previously in connection with the HSC equipment as an independent brake valve. It has been designed for separate mounting in order to provide greater flexibility of location in the Diesel cab. For steam-locomotive service the independent brake valve is located on the automatic brake-valve body.

The next major item of the 24-RL equipment is the D-24 control valve. A control valve was selected, rather than a distributing valve, as it is desirable to separate the application or relay portion from the remainder of the valve for convenience in adding the electro-pneumatic and speed governor features. The control valve also incorporates an emergency portion which makes it unnecessary to employ a brake-pipe vent valve.

The D-24 control valve is arranged much like the D-22 type control valve, in that it has a pipe bracket, a service and an emergency portion. It is smaller and lighter and somewhat simplified as compared with the D-22-E control valve. It is also smaller and lighter than the distributing valve and provides advantages over the distributing valve in that a faster and more positive release of the rear unit of the locomotive is obtained when operating in multiple unit service. It provides

better graduation than is possible with the distributing valve. The brake cylinder pressure developed with the control valve is also exactly in harmony with the similar pressure development on the cars. The emergency portion of the control valve is similar to that used on the AB valve, thus facilitating maintenance. The D-24 control valve also provides automatic sanding in emergency.

The use of the control valve makes necessary the combined auxiliary, emergency and displacement volume reservoir for control of the relay portion. This reservoir is similar to that furnished in connection with previous locomotive control valve equipment.

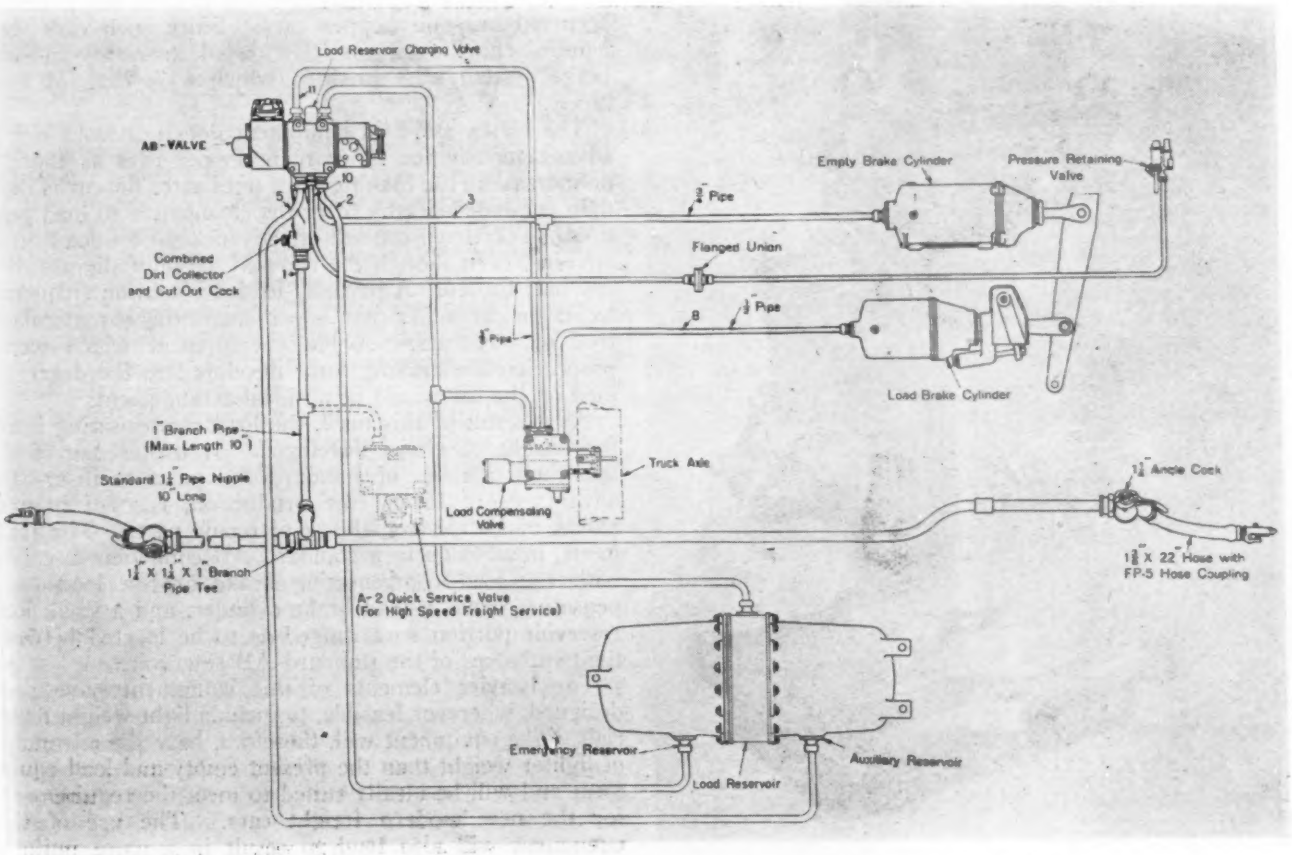
It is desirable to have the application or relay portion as a separate unit because it lends itself better to the addition of the electro-pneumatic, decelostat and speed governor features. Where speed governor control is employed, or contemplated for later use, the F type relay is recommended. This relay has provision for mounting the magnet valves required for speed governor operation and also includes a relay portion which is generally similar to the application portion of the distributing valve. If the electric features are not required, the familiar type B relay valve is used in place of the F type valve. These are the major new items of the 24-RL locomotive brake control.

Pneumatic Throttle Control

There is, however, a new development in pneumatic control for the locomotive which concerns throttle operation. For Diesel engine service, the self-lapping principle of the independent brake valve has been utilized to provide control for the engine speed. This portion of the equipment is called a Controlair. The Controlair is connected pneumatically through a single line of tubing to another device, called the actuator. Movement of the Controlair handle the desired amount causes the actuator to position the engine governor so as to obtain the change in speed desired.

More complete types of the Controlair equipment provide for reverser control in the same handle as is used to control the engine speed. Thus moving the Controlair handle forward from the neutral or idle position insures proper positioning of the reverser and also the increase of engine speed as desired. Movement of the handle in reverse from the neutral or idle position again positions the reverser for the proper electrical connections and then permits increase of the engine speed to the desired degree. These features are all suitably interlocked to preclude the possibility of their being improperly used. Either of the two Controlair systems will permit the control of more than one engine from a single Controlair by employing additional actuators and the necessary piping.

A similar throttle control has also been developed and applied to one of the newest and most powerful steam engines in operation today. On account of the different characteristics of the force required to operate the steam throttle and because of the considerable travel of the throttle arm of a steam throttle, a device known as a pneudyne is employed, in place of the actuator referred to above. The reversing of the locomotive in this case is also taken care of with the same Controlair handle as is used for the steam throttle operation. Suitable interlocks are, of course, provided. The advantages of the pneumatic system of control are obvious, in that it requires only a nominal amount of force on the part of the engineman to adjust the throttle to the desired position.



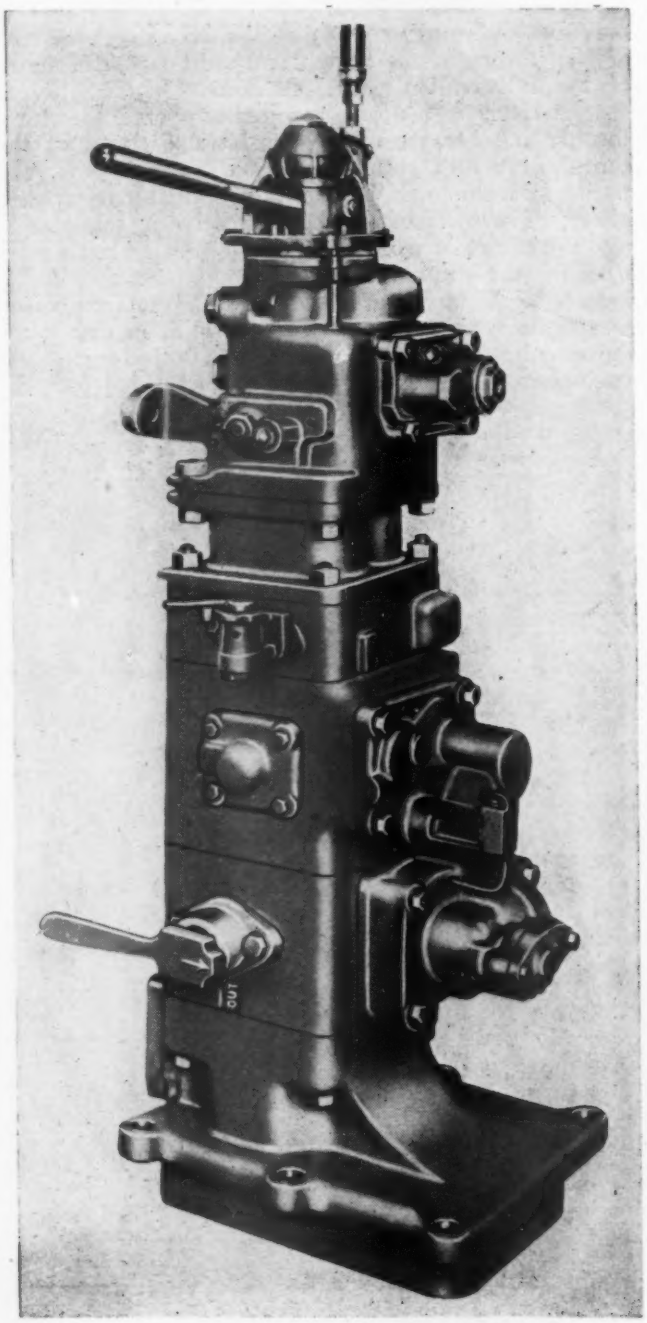
Piping diagram of the load compensating brake

It is also much easier to accomplish the installation of the tubing connecting the Controlair and actuator or pneudyne, than it is to install the mechanical system of levers, bell cranks, etc., otherwise employed.

Air Compressor

Another recent development for steam locomotives is the 8½ inch—150-E compressor. It incorporates the super-type steam governor directly in the compressor top head. This simplifies the steam piping and makes for more compact assembly. The main new feature is the mechanical lubricator. It is mounted directly on the high pressure cylinder, which method of mounting eliminates the need of all external piping, with the exception of the single line leading to the steam end of the compressor. The pumping units, of which there are three, are individually adjustable to give just the right quantity of oil feed desired to the points requiring lubrication. Oil is supplied to the steam end in the steam inlet passage, just before it reaches the governor, so that all parts of the steam portion are lubricated from this one source. Oil is also supplied to each of the high and low pressure air cylinders. The pumping units are cam driven, which insures their dependable and positive action. The oil passages of the high- and low-pressure air cylinders are drilled in the cylinder side wall, so that there are no external connections involved for this purpose. Having the compressor design such that it is complete with lubricator and governor all in a single unit is a distinct advantage in servicing the compressor.

All 8½ inch-150 and 8½ inch-120 air cylinders, whether furnished as repair cylinders or assembled in complete compressors, supplied since approximately January 1, 1944, have had the necessary bosses for mounting this lubricator. Suitable blanking covers are used to cover these bosses, when the lubricator is not employed.



DSA-24 brake valve

Freight Car Braking

The AB equipment, of course, remains the fundamental standard for freight cars in conventional service where the ratio between empty and loaded weight does not exceed 4 to 1 gross to tare. Many new cars, however, will be designed especially to provide lighter empty weight. Their carrying capacity can be the axle load limit of 169,000 lb. so far as the 50-ton car design is concerned. Many of these light-weight, high-capacity cars will exceed the 4-to-1 gross-to-tare-limitation, and for that reason some additional braking force should be provided. The additional braking force is needed to increase the ability to stop the car to the minimum value that experience has shown as necessary to properly control the movement of trains, especially if grades are involved. Any increase in train speed makes a train more difficult to stop, and correspondingly the need for adequate braking force is even more important. In the past this situation with respect to gross to tare, has generally occurred only on hopper cars. Since such cars were handled either empty or fully loaded, an empty-and-load brake system was provided which took care of them nicely.

The empty-and-load equipment does not work out so advantageously for other than hopper cars as there is no increase in the braking force until after the car is more than one-half loaded. After the changeover to load position has occurred the full effectiveness of the load brake governs, even though the car may be only slightly over one-half loaded. A partially-loaded condition frequently exists for cars other than hoppers, and this is particularly true of box cars. A brake equipment which would proportion the braking force developed to the degree of load on the car would be an ideal arrangement.

As a result of this need, the load compensating brake for freight cars was developed. It makes use of the maximum number of standard AB parts to insure the advantages of lower cost production, ease of maintenance, and wide availability of repair parts. The main items, in addition to a standard AB equipment involved with the load compensating brake are: a load compensating valve, a load brake cylinder, and a small load reservoir portion so arranged as to be located between the two halves of the standard AB reservoir.

The heavier elements of this equipment have been designed, wherever feasible, to include light-weight materials. The equipment will, therefore, have the advantage of lighter weight than the present empty-and-load equipment and will be ideally suited to meet the requirements for the new modern freight cars. The use of this equipment will also tend to result in a more uniform braking ratio throughout the train. This is particularly

desirable from the standpoint of slack control, as there will be much less variation in the retardation force developed on the various cars in the train, irrespective of whether they are empty, partially-loaded, or fully-loaded.

Braking Ratios

The table indicates the variation in braking ratio that will exist between light and loaded cars, having light-weight construction, and with and without the load compensating feature.

The table shows that any car which has a light weight of less than 40,500 lb., when braked at 75 per cent of the empty weight, will have a loaded braking ratio of less than the desired 18 per cent, unless additional braking force, such as the load compensating brake provides, is made available. A 38,000 lb. car has been mentioned frequently as immediately in prospect, and indicates on the chart the values applying for such a weight of car both with and without load compensation. It is to be noted that the lighter the empty weight of the car, the more important this compensating feature becomes to the successful employment of light-weight construction.

Comparative Braking Ratios With and Without Load Compensating Brake for Various Empty Car Weights

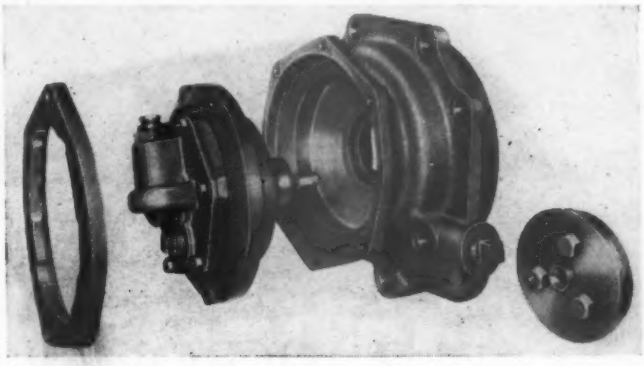
Empty wt., lb.	Axle load limit, lb.	Gross to tare	Empty car braking ratio, per cent	Single-cap. loading car braking ratio per cent 10-in. equip.	Optional percentage of loaded car braking ratio with load compensating brake
50,000	169,000	3.38:1	75	22.8	50
40,500	169,000	4.0:1	75	18.0	45
38,000	169,000	4.45:1	75	16.85	42
30,000	169,000	5.92:1	75	13.3	33
28,000	169,000	6.04:1	75	12.4	31

Another recent development in freight brakes is the AB-1-B equipment. This was designed to meet the requirements of freight cars occasionally assigned to passenger service or regularly operating in relatively short high-speed freight trains where the freight cars are provided with air signal lines. This equipment is the basic AB equipment to which a filling piece is added between the AB valve service portion and pipe bracket. This filling piece is actuated by the signal line pressure. When the signal line is charged, the three-stage brake cylinder pressure development necessary for slack control on long freight trains is modified to make the brake cylinder pressure development continuous, so that it will harmonize with the practice on standard passenger cars. This filling piece feature includes the protection of a safety valve for service applications, when operated in passenger trains. The safety valve is automatically cut out in such emergency applications. When the signal line is not charged, the AB-1-B valve automatically reverts to provide the standard AB features for freight car service. This equipment is not intended for use on passenger cars.

Passenger Brake Improvements

Passenger cars intended only for conventional speed service should be equipped with the D-22-AR control valve, with which you are quite familiar. If high-speed streamline passenger car operation is involved, higher braking ratios of 250 per cent based on 100-lb. cylinder pressure in emergency are necessary in order to keep stopping distances within proper limits. Such a high braking ratio cannot be permitted at the lower car speeds or excessive wheel sliding will be encountered. It is necessary, therefore, to reduce the braking ratio to values known by experience to give the highest possible retardation without wheel slipping under normally good rail conditions. The HSC equipment with the D-22-BR control valve and the electric speed governor should be employed for this class of car. The speed governor serves to reduce the braking ratio in the desired steps from the maximum of 250 per cent with 100 lb. cylinder pressure in emergency for speeds above 65 m.p.h. to values of 200 per cent, 150 per cent, and a minimum of 100 per cent as the speed decreases.

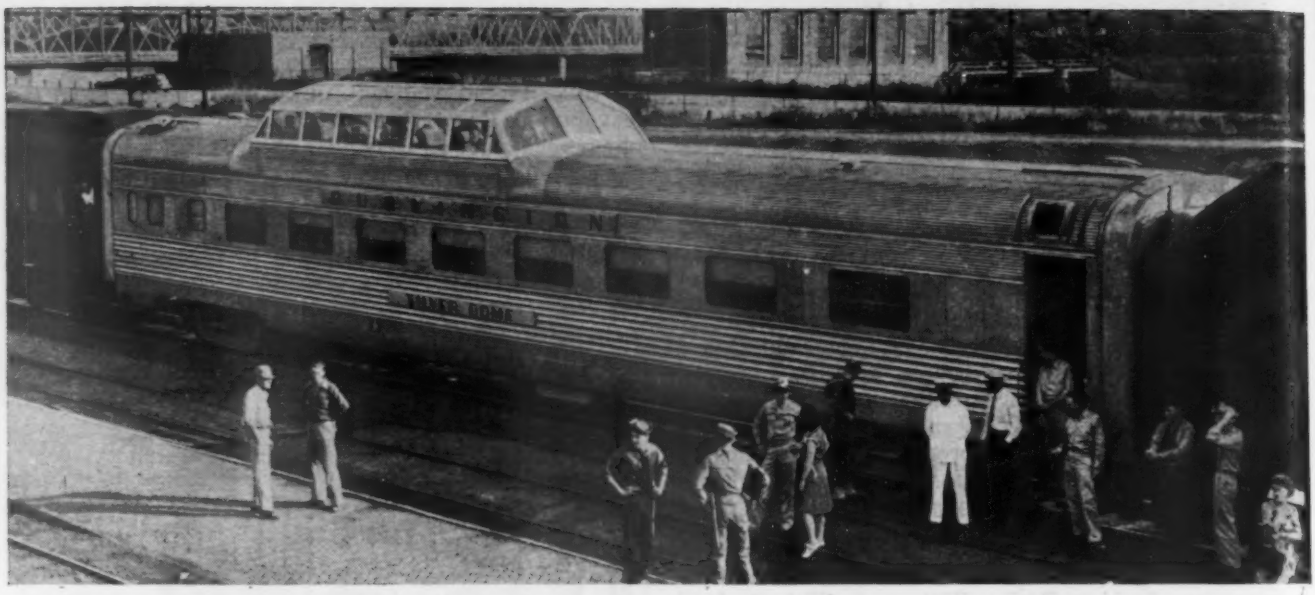
To obtain the maximum in flexibility of control, smooth handling and the greatest saving in time when making fast schedules, the electric straight air feature is recommended. This requires the No. 21-B magnet valve on each car. The electric feature eliminates the element of pneumatic transmission time, thus requiring less time in making stops or slow downs and in releasing after such applications. It also eliminates the probability of any slack action due to brake application, as all brakes in the train apply simultaneously.



AP Decelostat disassembled

While the foregoing features go as far as possible, without the addition of special equipment, to minimize the possibility of wheel sliding, they must be based on normally good rail adhesion or the stops will be unnecessarily long. To eliminate wheel sliding under adverse rail conditions, the type AP decelostat equipment was developed. This equipment involves, for one car set, four P-1 decelostats, two B-2 decelostat valves, and four pieces of small diameter flexible hose.

One of the P-1 decelostats is mounted on the end of each axle. There are no electrical connections or attachments required with this equipment and there are no additional connections required to the car body. The decelostat is a small but rugged pneumatic valve combined with a weight mechanism which measures the change in the rate of the wheel retardation. If the wheel retardation stays below a predetermined value, which experience has shown will not approach wheel sliding, the pneumatic mechanism is not required to function. In other words, brake cylinder applications and release occur in an entirely normal manner as though the decelostat equipment was not applied. The decelostat is constantly measuring the retardation rate of the wheel, however, and if the wheel does slip so as to exceed the rate for which the decelostat is adjusted, the decelostat operates to open the B-2 decelostat valve. This almost instantly operates to decrease brake cylinder pressure and thus soften the intensity of the brake application. All of this happens much more quickly than is possible for the wheel to actually stop rotating. The wheel, therefore, almost inmmediately resumes its rotation corresponding to the car speed and the brake cylinder pressure is promptly restored at a predetermined rate. If only one of the decelostats functions, the brake cylinder pressure on that truck only is modified as just described.



Vista-dome car at Ottumwa, Iowa

Burlington Vista-Dome Car

Stainless-steel car with glass-enclosed observation dome in the roof

FURTHER service tests developed "unanimous enthusiasm" for the Vista-Dome stainless chair car of the Chicago, Burlington & Quincy which has been rebuilt to include a steel and glass-enclosed observation compartment extending upward through the roof and made over 7,600 miles in the first two weeks of revenue service since the formal test run on July 23. The objective of the Burlington in making this practical demonstration of the dome-type construction, originally suggested by General Motors "Astra-Liner" designs, was to see if it is sufficiently popular and practicable to justify more extensive adaptation and use. The answer to the first question is already in the affirmative.

The Vista-Dome car, constructed at the Aurora, Ill., shop of the C. B. & Q., was by no means an easy car to build primarily because it necessitated fitting the glass-enclosed observation dome into an existing car and using only such materials as were readily available without drawing on critical war materials. Whereas the General Motors designs called for a depressed center section, the Burlington car was rebuilt without change in the underframe and main floor, seats in both the dome compartment and the main body of the car under the dome being arranged so as to take advantage of the decreased headroom required when sitting as compared with standing.

The Vista-Dome car, in this particular instance designated the Silver Dome, was made from a 79-ft. 8-in. streamlined stainless steel chair car, built in 1940 by the Edward G. Budd Manufacturing Company, Philadelphia, Pa. It provided 52 seats for passengers, not including seats in the women's lounge and the men's smoking room and, as redesigned, the seating capacity is 58. The height of the original car from rail top to roof was 13 ft. 6 in.; the height with the dome added is 16 ft. 2 in., which includes ½-in. camber built into the car body. Some older passenger cars are as high as 14 ft. 8 in. and the Burlington operates freight cars in special service which extend 17 ft. 3 in. above the rail top. The Vista-Dome car can be operated practically anywhere on the Burlington system without exceeding clearance limitations.

The glass-enclosed dome compartment is approximately 22 ft. 6 in. long by 10 ft. wide and contains 24 de luxe seats. The dome extends 2 ft. 8 in. above the former roof, which places passengers' heads and shoulders well above the roof line, giving them a good view in every direction, including forward and back over the top of the train. (Seats are reversible to suit the direction of movement of the car.) The distance from floor to ceiling of the dome compartment is 6 ft. 2 in. The car weighs 130,000 lb. compared with 110,000 lb. before the dome was added and compared with 165,000 lb. for a conventional car. Had the Vista-Dome Dome car been built new, it would not have been much heavier than the original stainless steel chair car.

Trucks used under the rebuilt car are the original trucks, equipped with Timken roller bearings and having lateral and vertical snubbers applied, also stabilizers to resist car sway. While the car was notably easy riding in early tests, it is expected that other improved trucks will be tried under this car in an effort to determine which design functions most effectively in cushioning road shocks.

Owing to the unavailability of curved glass or suitable transparent plastics in war-time, the windows and roof of the dome are constructed of double-pane flat glass. The outer pane is a heat and sunray resisting glass, separated by an air-space from the inner pane which is safety glass. The air-space serves as an insulation against heat

and cold and the provision of dry air between the panes prevents fogging or frosting, which would impair the view from the dome.

The dome section, as well as the balance of the car, is scientifically air-conditioned to insure comfortable temperature and ample ventilation in summer or winter. Illumination is so arranged that, at night, all lights in the dome except those illuminating the floor can be extinguished. This permits passengers to see the right-of-way ahead illuminated by the locomotive's headlight and, on many nights, the entire countryside bathed in moonlight.

For the present at least, the Burlington contemplates that no extra fare will be charged for riding in the dome, although passenger traffic officers anticipate that the popularity of this scenic vantage point may create a problem.

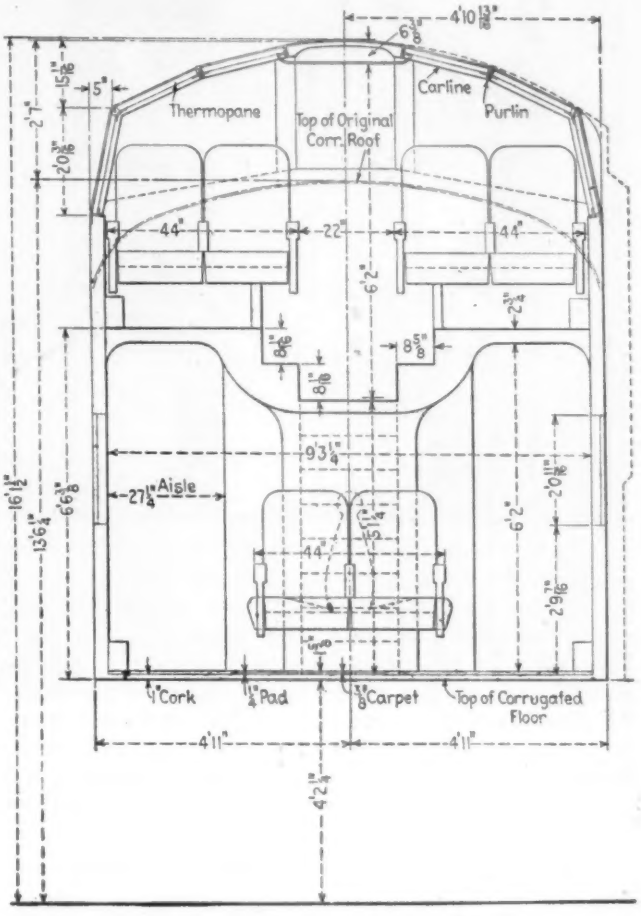
Coincident with the installation of the dome compartment, the main floor of the car has been remodeled and refinished. The main passenger compartment contains 18 reclining chair seats in conventional arrangement. Beneath the dome space, there are 16 seats, 4 of which may be used to form a card-playing section and 12 being placed back-to-back and facing outward toward the windows. The latter are separated by a glass partition. A short stairway, so designed that passengers instinctively grasp double handrails, leads up to the dome compartment. A large women's lounge and a spacious men's room are located at opposite ends of the car.

How the Dome-Car Was Made

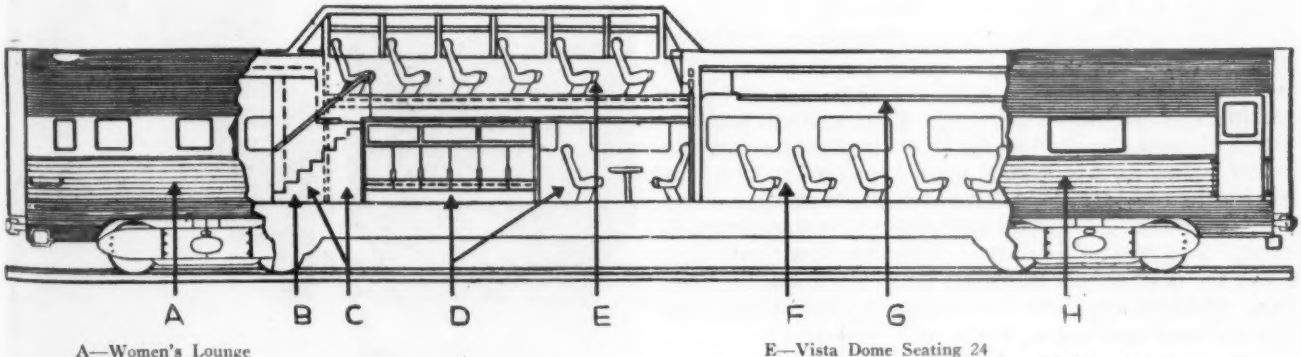
In rebuilding and reconditioning this car at the Aurora shops, both design and construction details were dictated in many instances by the fact that the car was not a new design. For example, the limited headroom available with a straight rather than a depressed center construction, placed definite limitations on how space under the dome compartment could be used. In view of the urgent need for employing only such materials as were, for the most part, already on hand at Aurora shops, many substitute materials and, by the same token, fabricating methods, were utilized. Stainless steel sheets and pressings, joined by the Budd Shotweld process, were used when available in the desired thicknesses, but it was necessary to use arc-welded carbon steel structural shapes for the dome frame, for example, and aluminum sheets for some of the wainscoting and ceiling below the dome. Exterior roof and side sheathing is entirely stainless steel.

The dome carlines consist of T-sections extending in one piece from side plate to side plate and the purlines are short T-sections of the same size welded between the carlines. As stated, these T-sections are carbon steel, made by cutting an I-beam of the proper size along the web center-line with a cutting torch.

Longitudinal forces in the car, as rebuilt, are carried through the dome section by means of reinforcing plates and shapes inserted in the car sides just above the windows. This reinforcement extends well ahead and back of the dome itself in order to assure a strong, rigid and permanently straight construction. The floor of the dome performs many of the functions of the roof such as tying upper portions of the sides together, also resisting torsion and latitudinal bending. Structural partitions transmit such forces from the roof to the dome floor. Longitudinal beams in the dome floor are supported by structural partitions at the ends and middle of the dome region.



Section through the Vista Dome



A—Women's Lounge
B—Enclosed Stairway
C—Coat Rack and Luggage Compartments
D—Twelve Longitudinal Seats and Four-Seat Card Section
E—Vista Dome Seating 24
F—Main Passenger Compartment Seating 18
G—Ovehead Luggage Rack as in Original Car
H—Men's Lounge

General arrangement of the passenger-carrying compartments of the car

Even the staircase which gives entrance to the dome is designed so that some of the step treads and risers, as well as the staircase sides, perform structural functions.

The dome compartment is thoroughly insulated with J. M. rock cork board-type insulation. Glass used in the dome consists of Libby-Owens-Ford Metl-Flex Thermopane, the front, back and top of the dome comprising double laminated panes of ⅜-in. safety glass separated by a ¼-in. air-space, the outer pane having heat and sunray resisting properties. Side windows in the dome have one pane of ¼-in. heat-absorbing glass, then a ¼-in. air space and a ⅜-in. pane of safety glass on the inside. All glass is sealed in steel frames. The steel dome frame is covered on the outside with stainless steel and on the inside with a thin layer of wood, both for insulation and appearance purposes. In fact, the dome interior utilizes wood finish except for the center ceiling duct.

Luggage space is provided at the sides of the stairway

Light and Air-Conditioning Equipment

No change was made in the method of heating and air conditioning the front and back sections of the car. The original G.E. 20-kw. belt-driven axle generator and Exide 1000-amp. hr. battery were retained, also the original Trane 7½-ton air-conditioning unit with motor-driven 4-cylinder compressor and Trane evaporative condenser unit. The center ceiling duct in the original car was cut out at the dome section and replaced by an air-duct passing vertically upward through glass walls in the center window at the front of the dome and thence into the center ceiling duct, equipped with Aerofuse circular outlets for the cool air. Side ducts and outlets just below the window level also distribute cool air in the dome compartment. The return air duct in the dome front wall just above the floor simply transmits air to the lower car floor from which it circulates back through the car and into the overhead return duct in the usual manner.

For air conditioning underneath the dome compartment, outlets are included in the rounded ceiling panels. Positive circulation of cool air to this and all other parts of the car, especially the dome compartment, are assured by supplementing the original ¾-hp. electric-driven blower with another motor of the same size, direct connected to three blower fans, one in the ceiling and one in each side duct leading to the dome.

In spite of the increased air-conditioning load as a result of installing a glass-enclosed dome in the roof of this car, temperatures in the dome compartment during the test run were kept down to 78 deg. F. with a maximum outside temperature of 103 deg. F. To achieve this effect, however, required practically continuous operation of the Freon compressor unit while handling the peak cooling load.

Looking through a side corridor under the dome

Car heating equipment also was little changed by addition of the dome to this car. When necessary, hot air is delivered to the dome compartment through the center ceiling and side air ducts. This heat is supplemented in the usual manner by floor heat from Vapor fin-type radiation units located along the floor on each side of the dome and controlled by two Vapor thermostatically-operated heat valves.

Attractive and effective electric-light fixtures have been installed throughout the rebuilt car. In the dome compartment, there are six Luminator 6-light fixtures on each side of the center ceiling air duct, making a total of seventy-two 15-watt lamps or 1,080 watts. Aisle lamps are installed under the seats, as previously explained, consisting of five staggered fixtures with a 6-watt lamp in each. Fourteen 6-watt stairway light fixtures are also used, one on each side of every step.

Under the dome compartment, four Luminator aisle-light fixtures are installed, also 12 magnifying-lens 25-watt reading lamps, supplied by the same manufacturer and installed one over each of the longitudinal seats. This same type of light is also installed over each cross seat in the card table section.

Center ceiling and baggage-rack lights are unchanged in the main passenger compartment, but important improvements have been made in the men's and women's rooms where ceiling lights have been removed and built into the curved edge of a box-like construction at the top of each wall. These lights are 25-watt and covered with attractive, curved plastic shields. The increase in lighting load from 1,550 watts in the original car to 2,664 watts in the rebuilt car necessitated installing one additional lamp regulator and 11 more light switches.

In the original coach, the chairs were upholstered in Collins & Aikman warm gray mohair. In the rebuilt car, seats and carpets for floors, including the hallways, are a peach color, window drapes in the main passenger section being blue. The lower walls under the dome compartment are a red tile and the upper walls, pale yellow paint on metal inside finish. Longitudinal seats under the dome facing the windows are upholstered in the same material and were consructed at Aurora shops. Above the center seats are glass panels which serve the double purpose of promoting seat privacy and desirable decorative effect. The dome compartment is finished in grey and green with a maroon carpet. The stair carpet to the top step is peach. The stairway below the hand rail is stainless steel, the upper walls of the stairway being finished in a surf green.

Looking forward in the dome—The cool-air duct in the ceiling is supplied through the double-glass wall in front of the aisle—The return-air grille is shown at the floor

Special attention was given to the men's and women's lounges, the latter being finished in a turquoise green for the built-in settee and salmon for one chair and the dressing table, the same color being incorporated in the drapes. The floor covering is a light brown Armstrong linoleum. Walls are beige cream and ceiling in the same color. White vitreous enamel lavatory and dental fountain are enclosed, with stainless steel covering all pipes. This boxed-in construction is used to conceal the pipes and provide covered space for towels. Dispensaries and other receptacles are included in the upper box construction which carries the light fixtures.

Antique tan leather is used for settees in the men's lounge, the floor being a blue-green Marbelle linoleum. The upper walls are beige and the lower walls a cinnamon brown. The same boxed-in construction of lavatory fittings is provided as in the case of the women's lounge. Light fixtures, built into the box construction at the upper side wall, as stated, utilize the rounded translucent plastic shield to give an attractive modernistic effect. All trim throughout the car is stainless steel.

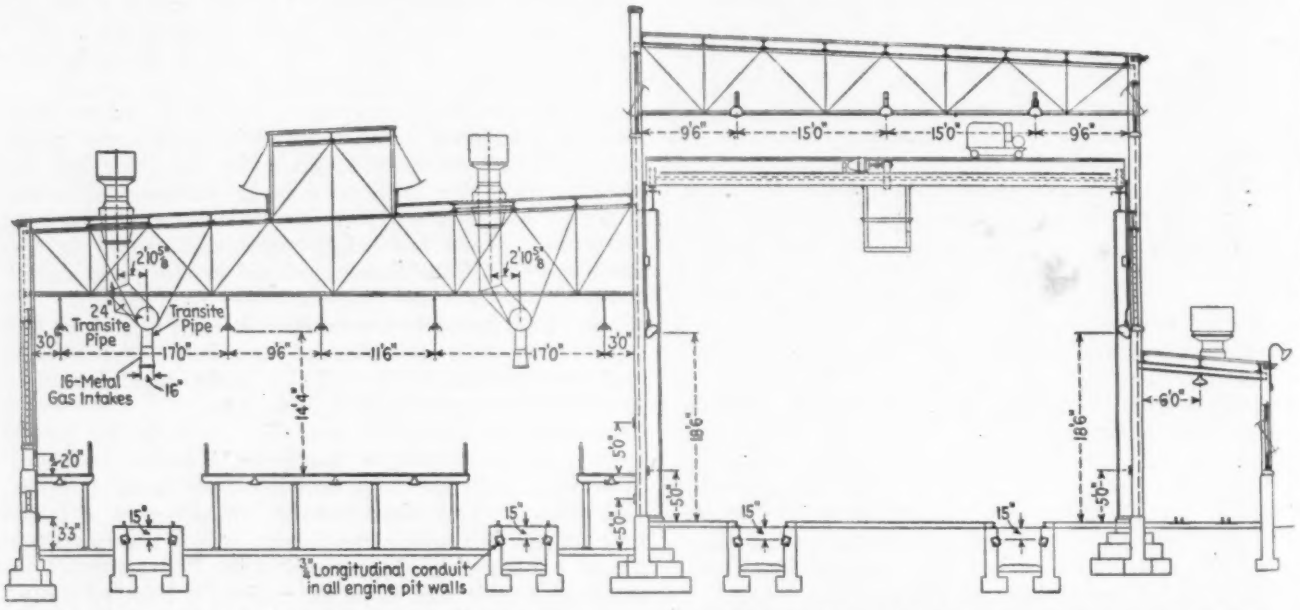
A locomotive moves into the service shop

Erie Diesel Electric Shop

Maintenance facilities for repair of electrical equipment of Diesel locomotives at Marion, Ohio show ingenious designing and practices

THE Erie Diesel-electric shop at Marion, Ohio, is characterized by numerous electrically operated automatic and semi-automatic devices which facilitate the movement of locomotives through the shop for both inspection and maintenance purposes. On the approach tracks to the shop are an entirely automatic sand handling plant, fueling facilities and automatic washer. Details of the automatic sand handling equipment with its photo-electric and pressure-switch control will be described in a subsequent article.

Having been served by these facilities, the locomotive continues on toward the shop where an electric eye starts a door opener allowing the locomotive to run into the service shop without stopping and without attendance from a ground crew. The two main sections of the build-



An elevation of the shop showing arrangement of tracks, depressed floor, elevated platform, exhaust ventilators, and location of lights

ing are respectively the service shop and the maintenance shop.

Locomotives coming in for inspection pass through the service shop going out of doors at the end opposite the entrance. Tracks in the service shop are at ground level. The floor is depressed 33 inches below the head of the rails and the depth of the pits between the rails is 48 inches. There is a drop pit large enough for trucks in each track near the entrance door. A wood floor at locomotive deck level is supported on columns made from scrap flues.

At the exit end of the service shop provision is made for trucking across the tracks both on the floor and platform level. This is accomplished by electrically-controlled air cylinders which swing sections of the rails out of the way and lower platform bridges to allow for trucking and which swing the rails into place and raise the platforms when a locomotive is ready to leave the shop.

Pit lighting in the service shop

Fuel Oil

Fuel oil is pumped from the receiving point to the four 25,000 gal. storage tanks and from the storage tanks to the fueling and sanding station by two 300 g.p.m. centrifugal pumps each driven by a 10-hp. motor. At present fuel oil is delivered by highway trucks, but it will be received from tank cars when they become available for this purpose. The pump supplying the fueling station is started and stopped by remote control from the fueling station. It supplies oil through a 4-in. line and holds pressure on the four filling nozzles which allow for fueling a four-unit locomotive from one position. Constant oil pressure is maintained by a relief valve and by pass. Electrical controls and valves are so arranged that either pump may be used for fueling or for filling the storage tanks. The pumps are housed in a building 18 ft. by 20 ft. and all oil is metered.

Washing Machine

From the fueling stations, the locomotive proceeds to the automatic body washing machine. This consists of four rotating brushes on vertical shafts each driven by a 3-hp. motor and a number of perforated vertical pipes supplied through two 2-in. solenoid-operated water valves, and pipes drained in cold weather by one ½-in. solenoid valve.

The motors are each controlled by a combination line starter connected to a track relay. When a locomotive reaches a point 12 ft. from the washer, it passes an insulated joint and shunts the track relay by shorting the rails. This starts the motors and opens the solenoid valves and the locomotive proceeds through the washer at a speed of about 80 ft. per min. When it reaches a point 10 ft. beyond the washer, it passes another insulated joint which opens the rail circuit, stops the motors and closes the solenoid valves.

The motors are 3-phase, 480-volt, 60-cycle machines and all control apparatus has 120-volt operating coils except the four combination line-starters for the brush motors which have 480-volt operating coils.

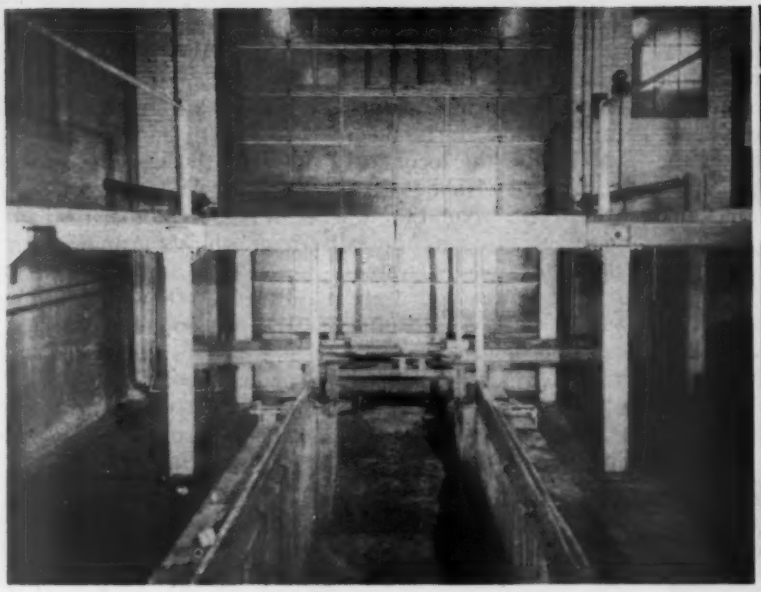
Connections to the rails, to the track relay and to the track circuit transformer are made through a two-conductor, No. 8, Parkway cable. Power circuits are run in three-conductor No. 8, Parkway cable protected by conduit where it is run down a pole into the ground. The conduit is grounded by a driven ground and the body of the washing machine is grounded to the water line. Because of the excessive moisture, the flexible leads, including a ground wire to the motors, are enclosed in water hose.

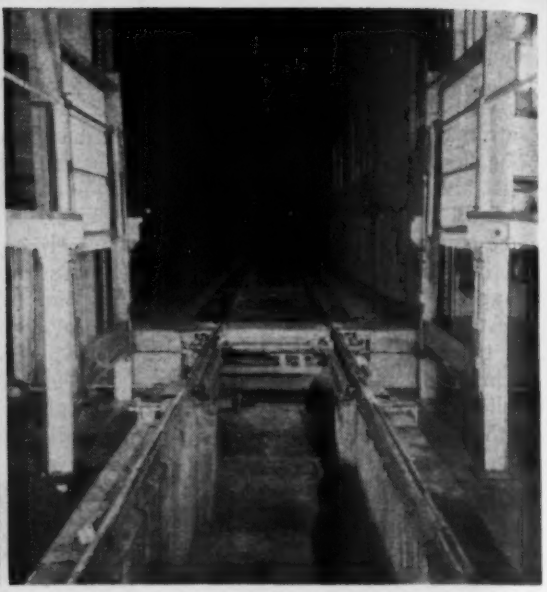
Trucks are washed with a high-pressure hand hose and nozzle at the fueling station and the ends of the locomotives are washed by hand in the service shop.

Automatic Door Openers, Rail Closers and Bridge Operators

From the washer, the locomotive proceeds along a slightly curved track to one of the two doors in the service shop. At a distance of about 200 ft., the headlight beam falls upon a photo-electric relay which starts a door-opening device driven by a 1-hp. motor. When the door rises to full open position, a limit switch stops the motor. The photo-electric relay is protected from operation by the daylight by a tube about 18 in. long. The headlight beam shines into the tube and operates the relay. Daylight will not operate the relay even when it is so bright that the light from the headlight can not be seen against the wall. The doors are closed from a push button station in the shop after the locomotive is inside. The doors are usually left open in warm weather.

One of the photo-electric relays which operates an inbound door in the service shop





Upper left: Outbound door of the service shop showing rail sections swung to each side and elevated platform bridge in place to permit cross —Upper right: Out-bound door open with rails in position and platform bridge raised to clear way for a locomotive

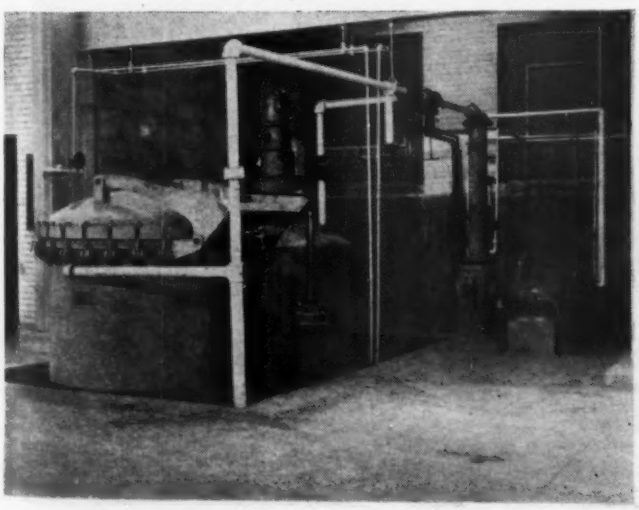
Above: The repair shop is lighted by fifty-six 400-watt high-intensity mercury lighting units—Left: Interior of the service shop as it appears at night under fluorescent lighting

One of the heating units in the service shop

When the locomotive is spotted in the shop for inspection, motor-driven exhaust ventilators match the exhaust outlets on the locomotive and a pillar-mounted push-button station is adjacent to the side window at the engineman's position. When the inspection is complete and the locomotive ready to leave the shop, the engineman reaches out of his cab window and presses the top button on the pillar. This starts a bell which rings for fifteen seconds. It also causes the outgoing door to open in the same manner as the incoming door. It swings the open (hinged) sections of the track into places and raises the two halves of the deck-level jack-knife platform bridge. As soon as these three operations are complete, a green light adjacent to the door and another on the control pedestal are lighted through an interlocking circuit and the locomotive may leave.

The two sections of tracks which swing to each side to clear a passageway on the floor level are 7 ft. long. They are moved by air cylinders and control of the air is affected by solenoid valves, one for each direction, operated by push buttons. Limit switches shut off the air to the cylinders after each operation is complete. The same push buttons which operate the rails control similar air cylinders which raise and lower the platform bridges. They also control the operation of the door, though this may be kept open if desired. A second set of push buttons alongside the door perform the same functions.

The various limit switches are wired in series so that the green light circuit is closed when the shop door is all the way open, both halves of the lift platform are in the clear, and both swing rails are closed and locked. All control apparatus is operated from a 120-volt circuit, while the motors operate on 480-volts.



Impregnating tanks and auxiliary equipment

Lighting

The area around the fueling and sanding station is lighted by nine umbrella type standards and four R.L.M. units mounted on brackets on the structure. Each unit is fitted with a 300-watt lamp and the mounting height in each case is 15 ft. from the ground to the lower edge of the reflector. Control switches are located on the structure supporting the sand storage tanks.

The standards are made of flues and pipe. The lower five-foot section is a 5½-in. flue welded to a 12 in. square base plate which is bolted to a concrete base. A section of 3½-in. flue fitted into the lower section extends the standard to 10 ft. where the 3½-in. flue is swedged down to fit over a 2-in. pipe which supports a lighting unit with a nearby hemispherical reflector. A 6-in. by 2-in. hole near the bottom of the lower section allows for making connections between the service cable and the fixture wire. The hole is covered by a curved cover plate secured by two cap screws. Service to the standards is made by No. 12 Parkway cable.

The bake oven is placed in a bay which is large enough to accommodate a second oven

The tracks approaching the shop are lighted by four 1,000-watt floodlights mounted on the roof of the shop.

Fluorescent lighting is used in the service shop above the deck-level platform. The shop, which is 220 ft. long and 61 ft. wide inside, is lighted by 54 units each consisting of two 100-watt lamps with Tulamp auxiliaries in a trough type fixture with open ends. There are three rows of lamps over the center platform and one row over each side platform. Mounting height is 14 ft. 4 in., longitudinal spacing is 20 ft. and lateral spacing is shown in the drawing. The mounting positions are made possible by suspending the fixtures from stranded steel messengers stretched lengthwise of the shop.

Under-platform lighting is accomplished with four rows of thirteen 150-watt units per row in R. L. M. reflectors mounted close to the under side of the platform. There are two rows under the center platform, one row on either side of the two tracks and six additional units in the center space.

The repair shop, which measures 49 by 220 ft., is lighted by 56 400-watt high-intensity mercury lighting

Approach track showing sanding and fueling facilities in the foreground —The washer may be seen through the framework and the shop in the background

units. Thirty of these are mounted over the crane, 40 ft. above the floor. Lateral spacing is 15 ft. and longitudinal, 20 ft. There are also mercury units in angle reflectors 18 ft. 6 in. above the floor, ten along each side wall and three on each end. All mercury units are suspended on hooks and are fitted with a short lead and plug for connection to a receptacle placed at each fixture location.

Pits in both the service and repair shops are lighted by vapor-proof units placed 15 in. below the base of the rail and tilted slightly upward. They are spaced 16 ft. apart and units on opposite sides of the pit are staggered.

Incandescent lighting is used in the cleaning room and reconditioning room at the east end of the shop, in the locker room and the lubricating oil storage room located respectively under the cleaning and reconditioning rooms and in the bays alongside the repair shop which are used for cleaning rooms, bake ovens, impregnating tanks, wheel storage, etc. Vapor-proof units are used where conditions require them.

Shop Motors

A three-phase, 480-volt, 60-cycle power distribution system is used for shop motors. Unit heaters are used for most of the heating and there are exhaust fans which draw air through the exhaust hoods over each engine location in the service shop and through the exhaust heads in the cleaning bays.

Four 5-hp. motors in the service shop drive fans in the unit heaters. Three 3-hp. unit heaters supply the repair shop and a 1-hp. heater is used in the lubricating-oil storage room and one in the parts reconditioning room. A ¾-hp. motor drives each of the eight exhaust fans in the service shop and the exhaust fans in the cleaning bay. A 1-hp. motor operates each of the four door openers. Two 3-hp. pumps in the oil-storage room and one in the service shop are used to move fresh oil and oil to be reclaimed. A fourth pump supplies distilled water which is obtained from condensate taken from the steam coils used to dry the sand. The drop pits are too low to drain into the sewer and a ½-hp. sump pump is used to move drainage water out of the pits. The two drop-table motors are rated at 20 hp. and ¾ hp.

Machines in the repair shop requiring motors are the vacuum pump for the impregnator, two engine lathes, a 20-in. emery wheel, a radial drill, and a 2-in. pipe-threading machine. Several small machines requiring fractional horsepower motors are used in the reconditioning room.

The 25-ton crane which serves the repair shop employs three motors of 5, 10 and 40 hp., respectively, operated by a suspended push-button control station from the floor. The control may be operated from the crane cab if desired.

Locomotive Maintenance Procedure

The manufacturer's recommendations covering inspection and maintenance of electrical equipment are followed to the extent that locomotive assignments permit. In addition, shop records are kept to show the history of each piece of electrical equipment. At present no rewinding is done.

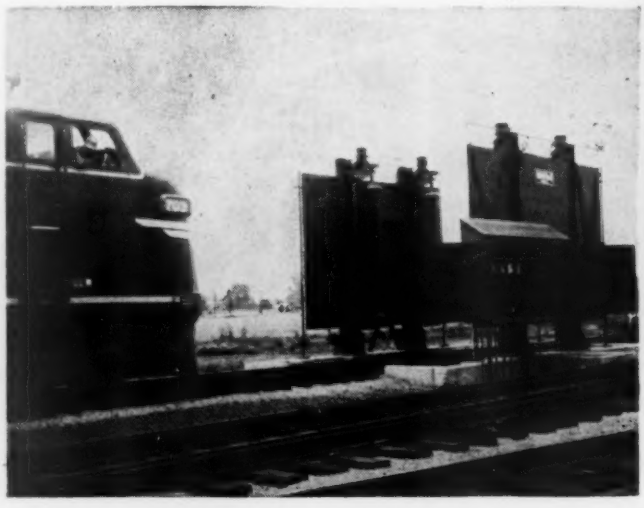
Traction motors and gears are removed in accordance with requirements as indicated by the progressive maintenance chart and motor record. The motor is meggered, completely dismantled and cleaned. Loose dirt is blown out and the armatures cleaned with cleaning fluid. If necessary commutators are turned on a lathe and undercut and any defective bands are replaced.

Armatures are then preheated in the oven, impregnated, and baked 20 hours at 135 to 140 deg. C. High potential testing is used for the annual test and for locating trouble.

Motor commutators are normally kept in condition by grinding them in place. To do this a pair of driving wheels is raised off the rail about three-quarters of an inch by means of 25-ton hydraulic jacks. One pair of brush holders is removed and replaced with a carborundum grinding fixture and the grinding is done by running the motor at a speed of about 300 rpm., with current supplied from a portable d. c. welder. The motor is blown out afterward and foreign material is cleaned out of the commutator slots with air.

This work takes about 1¾ hours and can be done on one motor during a daily inspection. The need for grinding is generally indicated from the motor record which shows rate of brush wear and breakage.

The same procedure is used on motors in trucks which have been removed from a locomotive. Generator commutators are ground by the same method, with the engine running a little below idling speed.



A locomotive approaches the washer

Western Maryland

Instruction Car

Courses in seven subjects given to operating and mechanical department employees — Demonstrations with actual working models are aids in training

THE Western Maryland has completed and placed in service on its lines an instruction car which is used in the training of new employees and for familiarizing old employees with the operating features of new equipment installed on the road or for training them to undertake new duties. Instruction is given in seven different courses covering: air brakes; mechanical equipment on steam locomotives; mechanical equipment on Diesel-electric locomotives; fuel conservation; water treatment; signaling; and safety. Since the car has been in use approximately 200 classes have been held, the weekly average is 16, with a total of about 3,000 man lectures to date. At the present time about 75 per cent of those attending classes are men from the operating department of the road, the remainder being from the mechanical department.

The car has been divided into two sections, an office and a classroom. The instruction portion of the car is 55 ft. in length from the door entrance to the office partition. The seating capacity of this section is 34. The classroom has been finished with a cream-colored ceiling, mahogany side walls and a blue marble inlaid linoleum floor. Adequate lighting is obtained by the use of seven individual fluorescent lighting units which have a total capacity of 1,400 watts. Six exhaust fans and two air-circulating fans provide the ventilation.

A boiler backhead has been installed in the car against the partition which divides the office from the classroom section. It is complete in every detail and comparable with the backhead of the most modern types of steam power except where additional values and gauges have been applied for the purpose of demonstrating the various types of feedwater heaters being used on the Western Maryland. A small firebox, with the back flue sheet in place and equipped with tuyere-type Hulson grates is built in the interior of the boiler head. The equipment includes the elevator housing and the distributor for a standard HT stoker. A steam whistle, scaled to half-size, is located on the left side of the boiler and is operated by compressed air.

A quarter-size working model of the Walschaerts valve motion which is complete in every detail and has a sectional valve chamber and cylinder was built at the Hagerstown locomotive shop for installation in the car.

The interior of the Western Maryland instruction car

The operation of the Walschaerts gear is explained and demonstrated with a scale model—The instructor is S. M. Roth, supervisor of locomotive performance

The various types of mechanical lubricators in use on the railroad are represented in the displays as well as a protection drifting valve, a complete boiler check, a blow-off valve and a blower valve. A Nathan, a Sellers lifting-type and a Hancock inspirator non-lifting-type injector are all demonstrated. Parts of a Worthington feedwater heater and diagrammatic views of the Elesco exhaust-steam injector, Type-T, are used to explain the functioning of these specialties. Sanders, cylinder cocks, drain valves, terminal check valves and various other operating valves are all explained by the use of sectioned parts. In addition, the car carries samples of a low-water alarm, Diesel-electric locomotive parts, a Hennessy journal lubricator and a grease cellar. On a panel board are mounted miniature size signals of the types standard on the railroad. These are electrically lighted and manually operated.

Test equipment required by the water-treatment engineer is shown and its use explained. This is supplemented by the use of stereopticon slides showing the effects of scale on the interior of locomotive boilers and the beneficial results obtained from water treating. Actual demonstrations are given of the treating process.

Brake Instruction

The car is completely outfitted with locomotive and car brake equipment. Full units of the No. 6 ET and No. 8 ET locomotive brake can be operated individually with or without train brake units, the piping in the car being so arranged that one set of engine and tender brake cylinders can be used when operating either brake.

Passenger brake equipment includes the older as well as the modern types; a P-type triple valve, two L-type triple valves, and a D-22-P with a D-22-AR control valve. The older type equipment is set up with air gauges to show auxiliary and brake-cylinder pressures. The D-22 control valve is equipped with gauges showing brake-pipe, auxiliary-reservoir, emergency-reservoir, displacement-reservoir, quick-action chamber, and brake-cylinder pressures. The instruction layout also includes an air signal system equivalent to that on a 12-car train which may be operated in conjunction with either the No. 6 or No. 8 ET equipment.

There are eight freight-car air-brake units on the car, including an AB-1-B type complete with an automatic slack adjuster and quick-service valve, an AB-type valve, and six K-type valves. Gauges are used on the AB-1-B equipment to show brake-pipe, auxiliary-reservoir, quick-action chamber, emergency-reservoir, and brake-cylinder pressures. Gauges on the AB brake show auxiliary-reservoir, emergency-reservoir, brake-cylinder, and brake-pipe pressures. On the K-types auxiliary-reservoir and brake-cylinder pressures are indicated by gauges.

Four of the freight-brake units are fitted with the latest type release control retainers, two have conversion-type release control retainers, and two have the original standard double-pressure-type retainers. One passenger brake unit is equipped with the standard single-pressure-type retainers. All types of retainers are mounted on a display panel. In addition there is a single-car testing device which is demonstrated on the brake units. Piping is so arranged that either an AB or the AB-1-B brake can be separated from the rest of the brakes for demonstration testing.

Other Equipment

A sound slide projection machine is used for showing safety lectures and other educational pictures; a stereoptican is employed for the projection of diagrammatic views of equipment. In addition there are numerous wall charts illustrating features of the various specialties in use on the company's locomotives. The car, which cost $50,000, was converted at the Western Maryland's Hagerstown, Md., shops.

EDITORIALS

Temperature or Vibration?

Traction-motor maintenance has been an item of major importance on roads using Diesel-electric locomotives in passenger service. In a few cases it has been exorbitant because of improper operating practices, but even under service conditions which meet builder's recommendations there are wide variations of performance records and repair costs are generally higher than those for motors on electric locomotives. This might be construed to lack of experience, but the situation exists also on roads with an electrification background.

A fairly common source of motor failure is the breaking of coils on the commutator end and the failure of insulation at or near the end of the coil slots, also at the commutator end. An armature removed from service frequently shows a ring of powdered mica close to the end of the slots, indicating a working of the coils in the slots. This will occur even when bands are still tight.

There are two schools of thought concerning the reason for this condition. One of these maintains that it is due to the sudden heating of the copper, particularly when heavy starting currents flow through the coils of a cold armature. It is thought that the coil expands faster than the iron laminations, causing it to creep in the slot and thereby crumbling insulation and bending the end turns of the coils. A suggested means of minimizing the effects of this condition is to ease or enlarge the slots near the end of the armature to reduce the bending strains on the coils.

The second school contends that the coils are not moved by temperature differences; that heat conduction is too rapid for this to be the cause and that temperature coefficients of iron and copper are essentially similar. Rather than creep due to temperature differences, it is held that this type of failure is due to vibration, particularly that of high frequency.

Those who contour-grind gear teeth claim to have proved this theory. When gear teeth mesh, the surfaces slide until about mid-position when they roll or rock and then slide again as they pass through the latter half of the contact period. This causes the teeth to wear out of contour, leaving a hump or relatively little worn portion at the pitch circle. This, it is contended, causes a vibration of double the tooth frequency which powders insulation and which is *not* avoided by using matched gears and pinions. One road regrinds to contour while another regrinds to an arc, both also removing the ridge at the edge of wear near the base of the gear tooth. Both claim to have sharply reduced insulation failures.

Possibly both temperature differences and vibration are contributing causes and, conceivably, there are other equally important reasons. Obviously, it is a subject which requires the meeting of minds and it is to be regretted that limited association activities restrict a free exchange of opinions and discussion of operating experiences. To those who have information to extend to their associates, the pages of this magazine are always available.

Coupler Welding

In 1942 a series of tests was conducted on welded couplers which resulted in the extension of Interchange Rule 23 to permit the reclamation of cracked couplers by welding following approved procedures in both the welding and the post-welding heat treatment of these parts. The test couplers in every case received the same tests as are required of new couplers and in no instance did failures occur in the weld or near the weld zone. Among the couplers tested was one which was welded completely across the shank, with the front end of one coupler and the rear end of another being joined. This coupler too met all tests.

This year's report of the Committee on Couplers and Draft Gears contains the following statement, "While your committee recognizes that such an operation could be satisfactorily performed if properly supervised, it does not consider that a practice of this kind should be recognized or permitted under the Association's rules governing the reclamation of couplers and parts." The necessity for this ruling came about because inspectors of the Mechanical Division had found couplers completely welded across the shank in service and brought the matter to the attention of the Committee.

The Committee's judgment in this case is not being questioned. We have from time to time indicated a belief that railroad mechanical departments were not as familiar as they might be with good welding practice. This action of the Committee tends to confirm this belief because, while acknowledging that there is nothing wrong with welding couplers in this manner, it indicates a lack of confidence in the ability or willingness of the railroads as a whole to follow the procedures which insure a good job. The question which must be raised is whether the railroads (and there must be a considerable number of them) which would fail to do this work in a "properly supervised" manner are at present doing work on couplers permitted under the emergency extension to Rule 23.

The same factors which affect the quality of work on joining coupler heads and butts through the shank section by welding affect the quality of work on cracked couplers which might be reclaimed by welding. If the railroads generally are not able to do the work which the Committee failed to approve, they are most unlikely to do acceptably any of the reclamation work on couplers specially allowed by Rule 23. It would be unfair not to acknowledge that there are roads which have done much to advance the use of welding on railroad equipment and whose procedures are carefully controlled. Penalizing them by revoking the extension clauses in Rule 23 would work a hardship and be a step backward. The fact remains, however, that there is a sufficient number of roads whose practices are such that the Committee does not feel justified in taking what is a logical step forward in view of test results and its own acknowledgment. It is to be hoped that the roads whose welding practices or shop heat-treating or normalizing furnaces are inadequate will recognize their shortcomings and initiate improvements. Welding is too valuable a tool to be restricted because of misuse.

Experience With The Vista-Dome Car

The Vista-Dome car, constructed at the Aurora, Ill., shops of the Chicago, Burlington & Quincy, as described elsewhere in this issue, made its first formal run July 23 in local train No. 45 from Chicago to Minneapolis, Minn., via the scenic Mississippi river route, returning the next day in local No. 52. The next trip on July 25 and 26 was to Lincoln, Neb., and back in two fast trains, and on July 27 the car left in the Exposition Flyer for Denver, Colo., then being routed over the Moffat tunnel line of the D. & R. G. W. to Salt Lake City and the Feather River Canyon route of the Western Pacific to San Francisco. After a short run to Spokane, Wash., and back, the car returned to Chicago and has since accumulated about 10,000 miles in general revenue service.

It will be noted, therefore, that considerable experience has been acquired in the operation of this car, both in local and fast through service, in scenic and in plains country, under temperatures up to 110 deg. F. and speeds approaching 100 miles an hour. Since one of the purposes of incorporating an observation dome in a chair car was to determine the public reaction to a spectacular new feature of car design, the comments of passengers have been listed; all are favorable and, in fact, enthusiastic. During the first five days of operation, 261 questionnaires were turned in, all indicating approval of the new facility. Most of the answers to the question, "Why?" mentioned the ability to see in all directions. Many spoke of the absence of noise which is quite marked, no rail or diaphragm noises penetrating the dome or any noise from passing trains except the locomotive as it goes by. There were many references to the cool comfort under a bright sun and to how smoothly the car rides.

The car was handled behind steam power over substantial distances but this was not objectionable and in some respects is said to add to the variety of the view. Passengers riding in the dome have the privilege, many of them for the first time, of viewing the railroad right-of-way and the track structure as it approaches. They are also in an excellent position to watch the operation of signals and, when a train is doing station work or taking coal or water, they can see what is going on and do not show the restlessness often exhibited in coaches and sleepers when trains are making station stops. Still another comment on one of the questionnaires was that riding in this car is the nearest possible approach to riding in an airplane without leaving the ground. From the point of view of passenger appreciation and enjoyment, there can be little question that this new type of observation-dome construction in passenger-carrying cars is desirable and likely to be demanded in the future.

As regards practicability in operation and mechanical details of design, there are many questions still to be answered some of which will have light thrown on them by experience with the Burlington car. For example, is a depressed center sill and underframe necessary and, if so, how much space can be spared from that now occupied by air-conditioning machinery, batteries and other underneath equipment? If a straight underframe is retained, as in the case of the Burlington car, what is the best arrangement of seats or other facilities in the limited headroom area? How high is it feasible to have the dome extend above the car roof? Should seat spacing in the dome compartment be generous, or can it perhaps be reduced to 36-in. centers? How much added power will be required for the increased air-conditioning and lighting load? What change, if any, in truck design will be necessary to control car sway with a somewhat higher center of gravity?

The Burlington's Vista-Dome car is admittedly an experiment and make-shift to the extent that the observation-dome has been applied to an existing car without change in the underframe. Undoubtedly a number of changes, both in structural design and interior arrangement, would have been made had the car been designed new from the ground up. There is nothing make-shift, however, about the appearance, decorative treatment, or equipment of the car, which is modern in each of these particulars.

An exceptionally workmanlike job has been done in rebuilding this car at the Aurora shops. It not only looks like new, but has stresses carried through the dome section with reinforcing members elsewhere which are designed to develop at least the full original strength of the car. To the Burlington goes the credit for courage and enterprise in being the first railroad to determine from actual experience how much merit there may be in the observation-dome idea, and how it may best be used.

Association Work More Important Than Ever

The war is over! In those few words is written "finis" to what was probably the most trying four-year period in all the history of American railroads. Of course, our trials are not all over yet, but at least the pressure is off and we can begin to get back to a semblance of sane and normal railroading, and begin also to look to the future and plan the moves that will enable the roads to profit from the many lessons learned during the war.

There are three extremely important facts that mechanical men—indeed all railroad men—must take into consideration as we approach the peacetime era of railroad operation:

(1) There will probably not soon be a period in which railroad motive power and rolling stock will again be put to such intensive use as has been the case in the past 48 months, during which time the attention of all railroad men was on the most urgent job of getting trains over the road without having had the usual opportunity for careful observation and the recording of the whys and the wherefores of performance. Now, therefore, is the time to pause long enough to place in the record the experiences that will serve to guide us in planning future motive power and rolling stock and the facilities with which they are maintained.

(2) We are not only going to have to meet the competition of other forms of transportation that have received a mighty impetus during the war period but we are going to have to discover that the industrial giant that developed what may be our competitors in the days to come has also conceived and brought to full stature many new processes and materials that we have got to learn how to make use of in the improvement of rail transport.

(3) There will be coming back home to us thousands of men who have helped to move by rail the men and materiel with which this war was won and these same men have had the enriching experience of operating railroads in the far corners of the world under all sorts of conditions. From these men there are many new lessons to be learned and to a great extent it is from this group of men that the supervisory and administrative staffs of the future railroads will be built.

These three general statements point unmistakably to the fact that the day of rule-of-thumb railroading is gone and that the day of trained technical and scientific railroading is here. These thousands of Army railroaders have been to school and they're not going to be satisfied with things as they always have been—they're going to want to have a part in improving them. In short, these men may well prove to be the spark plug that will put the railroad industry on its toes.

If there is anything in which the railroad industry has been shortsighted it is in not encouraging technical men to enter its ranks and in not adopting a policy of having its officers and supervisors get around the country to see what is going on. If anyone has any doubt as to how far behind the railroad industry is in the general technical character of its work and the dissemination of ideas among railroad men throughout the country one need only pick up some of the operating and maintenance manuals that will no doubt be amongst the souvenirs of the many Army and Navy men who will come back to the railroads and compare them with the "standard practice" and maintenance manuals developed in the railroad industry. If one is open-minded he can not help but learn a lesson in the value of up-to-the minute information.

Without doubt one of the greatest opportunities that railroad men may have to effect a rapid concentration of the technical information that is pertinent to their work, and to get it into the record for the benefit of the entire industry, is through association work. It is to be hoped that both officers and supervisors in the mechanical department will throw the entire weight of their support to such organizations as the Master Boiler Makers' Association, Railway Fuel and Traveling Engineers' Association, Car Department Officers' Association and the Locomotive Maintenance Officers' Association. The war's end should be a signal for all such groups to move forward to greater effort. The industry needs the information in the hands of their potential members.

NEW BOOKS

AMERICAN MALLEABLE IRON. *A Handbook. Published by the Malleable Founders' Society, 1800 Union Commerce Building, Cleveland 14, Ohio. 368 pages, 5 in. by 9 in. Price, $4.00*

This handbook contains, in 26 illustrated chapters, a full discussion of the chemistry, manufacture, and use of malleable iron, based on current practice and requirements. Chapters on casting design, pattern design, and machining practice offer practical data of direct usefulness to designing engineers and production men. Physical, mechanical and engineering properties of standard, pearlitic, and alloyed malleables are set forth in other portions of the book and correlated with requirements for the product as established by the American Society for Testing Materials, the Army and Navy, and other agencies responsible for current specifications. The metallurgical process is simply explained in another chapter, and a section is devoted to engineering tables and data, including a tabular summary of A. I. S. I., S. A. E., and N. E. steels and irons of comparable characteristics. In the chapter on machining practice are tables of feeds and speeds for drilling, milling, and turning. "Design kinks" in the chapter on casting design illustrate and explain a number of short-cuts in design made possible by malleable iron.

With the Car Foremen and Inspectors

Car Inspector's Problems*

By George Schadeff

The car inspector is required to make internal inspection of freight cars, classify them for commodity loading, and card the cars accordingly. In a great many cases the doors on these cars, especially on steel cars, are almost impossible to open without a bar. These doors are not being given the necessary attention on the repair track; the rollers are not being oiled; and, when bent at the corners and rails, the doors should be repaired and not forced closed with a bar and sledge, as the inspectors do not have the time or the tools on hand in their daily inspection to repair these doors in the train yards.

Drain Pipes on Refrigerator Cars—These pipes are found by inspectors quite frequently to have shifted, allowing the salt water to run directly into the oil boxes. The pipes must be wired back into postion. The oil-box lids on these cars are not being renewed and the water from the drains has a good chance to run into the boxes, causing water boxes and eventually a hot box. The inspector believes a little more attention should be given to the above features on this equipment when cars are on repair tracks.

Bottom Outlet Valve Caps Hanging Loose—Although this defect is cardable in interchange, the inspectors are finding a great many tank cars with the caps hanging by chains on cars coming off their line and from the various industries, and some in interchange. The inspector is required to get a large wrench, replace the caps and tighten them before cars are allowed to go forward. On some cars that have been previously loaded with asphalt and other thick commodities, he is required to bad-order the car, to hold it or send it to the repair track, as the thread of the cap is filled with dirt and frozen and he does not have time to clean the threads off and replace and tighten the cap.

Hopper Doors Open on Gondola Cars—Cars coming from industry plants, off the line, enginehouse coal chutes, etc., are arriving in the train yards with hopper doors open, or only partially closed and coal not thoroughly cleaned out by the consignee, which makes it difficult to close the doors. This matter should be taken up with superintendents to handle with agents and the offenders to have hoppers closed and coal cleaned out so that doors are completely secured before being allowed to come to train yards.

Sand Holes in Old Truck Sides—Sand holes, small checks and cracks in old-type truck sides, also badly rusted truck sides on L- and T-section truck sides have been a problem to the car inspector. Because of the shortage of time, the car inspector in many cases sets cars out with the above defects so that the cars can be given a second inspection on the repair track where more time is available, to avoid accident. We have had some serious derailments on the various railroads due to breaking down of truck sides, as some of these older cars equipped with the above truck sides are being given capacity loads during this emergency.

Defective Body Bolsters—In cases where body bolsters are cracked or broken at the side sill or outside of the side bearings, many inspectors are setting cars out under load on account of this defect for fear the car will be transferred at the next interchange point. Temporary repairs, if not permanent repairs, should be made to cars in such condition when they are on repair tracks empty.

Cars Not Properly Cleaned—When a train of empty cars (closed cars) or any empty cars come into train yards, the car inspector is required to make internal inspection, classify cars for commodity loading and card

* Excerpts from a paper presented at the March 5 meeting of the Northwest Carmen's Association at St. Paul, Minn.

† Mr. Schadeff is a car inspector of the Chicago Great Western at St. Paul.

Car repair track of the Chicago Great Western at Oelwein, Iowa

them accordingly. However, when inspectors open the doors they often find the floor completely covered with papers, refuse, straw, etc., so that it is impossible to make interior inspection, and cars must be carded either to the repair track or clean-out track for cleaning before an internal inspection can be made. This results in delay to the car. Although the Office of Defense Transportation has assisted greatly in getting the industries to clean out the cars, the consignee who unloaded the car should be required to do this cleaning.

Machinery Loads—When boxes of machinery are loaded on flat cars with high-tension holding bands, in some cases the bands do not have protection at stake pockets or knee braces to keep them from shifting. High boxes of machinery should have applied, in addition to high-tension bands, at least two anchor rods of ⅝-in. or ¾-in. material, to give added strength to the bands.

High loads of secondhand machinery, as well as new, should carry cards showing the dimensions of the load, height from top of rail and width at top, and should be marked, if clearances have been checked to destination. This will save the inspectors time in measuring up the load in train yards.

Inflammable Placards on Box and Auto Cars—The removal of inflammable placards on box and auto cars when empty in the train yards is getting to be a difficult problem for the car inspector. The placard boards on the newer type cars are so high up that inspectors are unable to reach them without the aid of a long stick. These cards should be removed by the one who last unloaded the car, a matter which also should be handled by superintendents and local agents with the people unloading the cars.

Side-Bearing Clearance Gage

The gage, illustrated, has been developed to determine side-bearing clearance before trucks are placed under cars and thus avoid the necessity of additional jacking to make necessary adjustments in case the clearance does not come within specified limits. In other words, the use of this gage gives a positive determination of the correctness of side-bearing clearance before cars are placed on their respective trucks.

Referring to the drawing, the construction of this gage will be readily apparent. It is made of ¼-in. by 4-in. mild-steel plate, offset 4 in., and cut long enough to space the two ⅝-in. by 4-in. end screws 50 in. on centers. Two ⅝-in. by 4-in. pins with rounded ends are welded to the central portion of the gage and a 2⅛-in. center hole permits slipping the gage over the king pin.

In operation, therefore, the gage is applied to the male bolster center plate on the car body and the end screws adjusted until they just touch the side bearings. Keeping the gage in the same vertical position, it is then applied to the truck bolster center plate and the space between the screw heads and the side bearings will be the clearance. Having this information before car bodies are lowered on the trucks enables side-bearing clearance to be determined accurately.

Lifting Clamps Keep Plate Flat

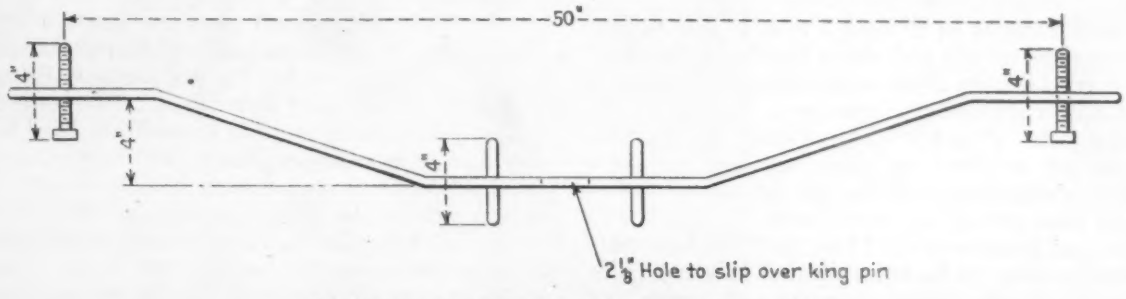
The illustration shows set of clamps used in handling long, narrow and more or less flexible steel sheets, either singly or stacked, at the Pullman car shops of the Pullman-Standard Car Manufacturing Company.

The clamps consist of two pairs of steel hooks, connected by spacing angles and equipped with four steel

Improved clamp for handling steel sheets

rings and wire slings in such a way that an upward pull by the shop crane exerts a lifting effect on the steel sheet at four well-spaced points which tends to keep the sheet horizontal and also have less tendency to buckle it than if a single pair of clamps were applied near the middle.

Each clamp, it will be seen in the illustration, is equipped with a set screw which can be tightened to prevent slipping. As originally designed, this was a hex.-head set screw which had to be tightened and released with a wrench. The improvement, submitted as a suggestion for time and labor-saving ideas by one of the shop men, consists simply of welding a small chain link



Side-bearing clearance gage which saves extra car jacking

on each of the set-screw heads so that the screw can be set up or released with the thumb and fingers. In case slightly more pressure is required than can be given by hand a 20-penny nail or the equivalent, inserted in the links, will give the needed additional leverage.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. A. R. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Validity of Repair Record

On January 11, 1943, the Southern Pacific exchanged wheels on car CDLX 292 and reported wheel numbers of new wheels to the owner in billing for the repairs. Again on March 26, 1943, wheels were placed in the same location in this car but the numbers of the wheels removed did not correspond to those reported to have been installed in January. The wheels removed bore manufacturers' dates several years old. The car owner requested the Southern Pacific to reduce its January billing to the value of second-hand wheels, contending that no intervening wheel exchange had been reported and that the wheel record of March should be considered as evidence that no new wheels had been applied in January. The Southern Pacific refused to do this and indicated in its refusal that twice during the intervening period the car in question had been off its lines and that the wheels in question could have been applied at one of these times by another carrier which did not notify the car owner of the wheel change.

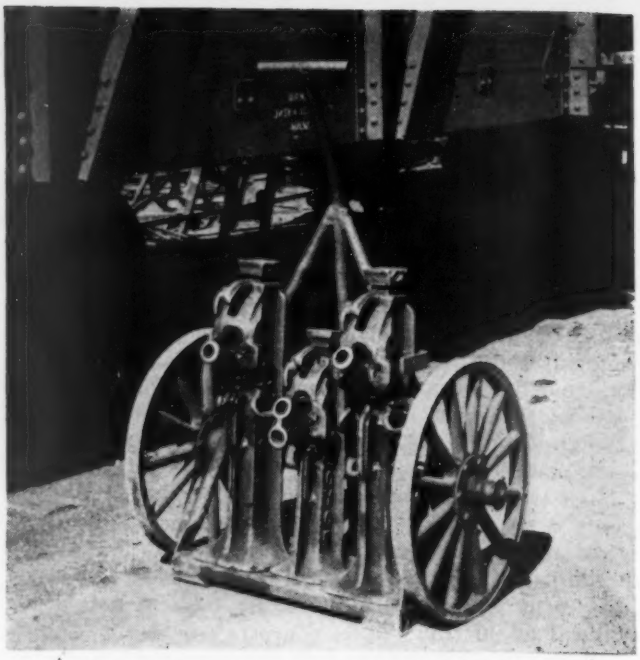
In a decision given on November 16, 1944, the Arbitration Committee said, "In view of the possibility of other wheel changes in the meantime, the billing repair card covering exchange of wheels on March 26, 1943, is not valid evidence that the identity of wheels on repair card covering exchange on January 11, 1943, is incorrect. The contention of the California Dispatch Line is not sustained." *Case 1806, California Dispatch Line versus Southern Pacific Company.*

Jack-Carrying Truck

A lightweight two-wheel truck, designed for use in handling four hand-jacks at a time about the car-repair shops and yard of the Green Bay & Western at Green Bay, Wis., is shown in the illustration.

This truck consists of a welded tubular steel frame, with a base plate on one end and a handle on the other, which is carried on two 23-in. wheels spaced 30 in. apart and located near the center of gravity of the truck when loaded with jacks. The truck moves easily although the wheels are not mounted on roller bearings but on a 1⅛-in. axle which extends all the way through a housing designed to form part of the truck frame.

The size and location of the 12-in. by 26-in. base plate is important to make the loaded truck well balanced. One lower edge is slightly further from the axle center line than the wheel radius so that when the jack has been tipped nearly to a vertical position, this edge of the base plate contacts the ground. The base plate of this truck is located with one edge 4 in. back of the axle center line and the other 8 in. ahead of it. The front edge is flanged down slightly to contact the ground and the back edge is flanged upward to keep the jack bases from slipping off. The jacks also rest against the axle housing at points near their respective centers so that, when tipped with either a single or full load of jacks in place, the truck is quite well balanced. There is no comparison between the small amount of work involved in moving hand jacks about the car repair yard with this truck and pulling and carrying them by hand. The truck is also useful in handling couplers and draft gears.



Two-wheel truck used in handling hand jacks, couplers and draft gears at the G. B. & W. car repair yard, Green Bay, Wis.

AB Brake Not Properly Maintained

The A.A.R. Mechanical Division reports in a circular letter dated August 1 that Type AB brake equipment, particularly as relates to brake-cylinder parts, are not being properly maintained in many instances. The Mechanical Inspection department has investigated the repairs of air brakes at the car and in air-brake shops and found it necessary to recommend cancellation of charges rendered against foreign line car owners for periodic attention given to Type AB brakes on several railroads thus far this year, due to failure properly to recondition brake cylinder pistons and associated parts in the shop, as prescribed by the manufacturers' instruction pamphlet No. 2391, Supplement No. 1, dated January, 1945, and as required by Interchange Rule 60.

Numerous failures properly to condition Type K brakes have also been reported, due to failure to complete all cleaning, repairing and testing in accordance with the requirements of the rule. The circular letter states that a list of all irregularities found would be superfluous as the rules governing the maintenance of air brakes are specific and complete in detail. It also requests particular

attention to conditions being found and urges that each railroad and private car owner make investigation in his own shops to see that required facilities are available and that air-brake work is being properly performed as required by the rules, instead of waiting until each individual shop is investigated by the A.A.R. Mechanical Inspection Department.

The Tank Car, Steel Soldier on the Home Front*

By J. J. Root†

The present world-wide conflict brought on by Hitler's mad lust for power and Hirohito's sneaking stab in the back at Pearl Harbor has created a greatly augmented demand for tank cars, which are now carrying, in addition to commodities previously hauled, such new products as Butadiene and Styrene, which are so important to our synthetic rubber production. Acids and Toluene used in the manufacture of explosives are also being shipped in ever increasing quantities.

Tank cars of special design with tank linings of aluminum, nickel, rubber, zinc, lithcote, etc., to resist the corrosive action of the lading, or to prevent its contamination, are now being used for the transportation of special commodities.

A large number of cars were specially converted for the transportation of component parts of 100-octane gasoline, and these cars have played a very important part in the war effort.

Due to losses and dangers to tanker transportation on the high seas, tank-car owners were asked to furnish, almost overnight, the equipment to move huge quantities of petroleum from the producing areas to meet the enormous requirements of the armed forces and of industry essential to the war effort. This accomplishment would not have been possible without the wholehearted co-operation of the petroleum industry. Vast facilities, consisting of racks, pumps, pipe-lines, loading and unloading points, were immediately installed by the petroleum industry, which resulted in a minimum of delay in the movement of tank cars. This industry likewise co-operated with tank-car owners in adjusting normal distribution practices to meet the emergency, loading and unloading tank cars twenty-four hours a day, seven days a week, and reducing the supply of cars for other purposes to the barest needs.

As an illustration of the tremendous job of transportation which is now being accomplished by tank cars in the United States, let me cite here a few almost unbelievable statistics. Every day in the week, 67 million gallons of petroleum and petroleum products are loaded into tank cars and started en route to delivery. This is more readily believable, however, when we are given to understand that during an 855-plane bomber attack on the city of Bremen, just 900 miles round trip from an English air base, one million gallons of gasoline were consumed; or that a B-29, fully loaded and using her four engines at maximum power, drinks up one gallon of gasoline a second in taking off the ground and climbing to leveling off altitude. To meet demands such as this, the United States alone produces daily 33½ million gallons of aviation gas.

There are now operating in the United States, Canada and Mexico approximately 167,000 tank cars, varying in capacity from 4,000 to 16,000 gal., of which about three-fourths are used in the transportation of essential commodities of war, and the remainder of the cars for other essential carrier needs. These cars have increased their mileage more than 400 million miles per month over pre-war movement, based on mileage figures for 1940.

Material and Manpower Shortages

The cars transferred from ordinary short-haul service to fast transcontinental movement required quick changes by the mechanical departments of tank-car companies and railroads. This, together with increased mileage, speeded-up railroad schedules, and scarcity of materials has presented serious problems in maintenance.

To further complicate the problems of maintenance, there is the serious man-power shortage, occasioned by

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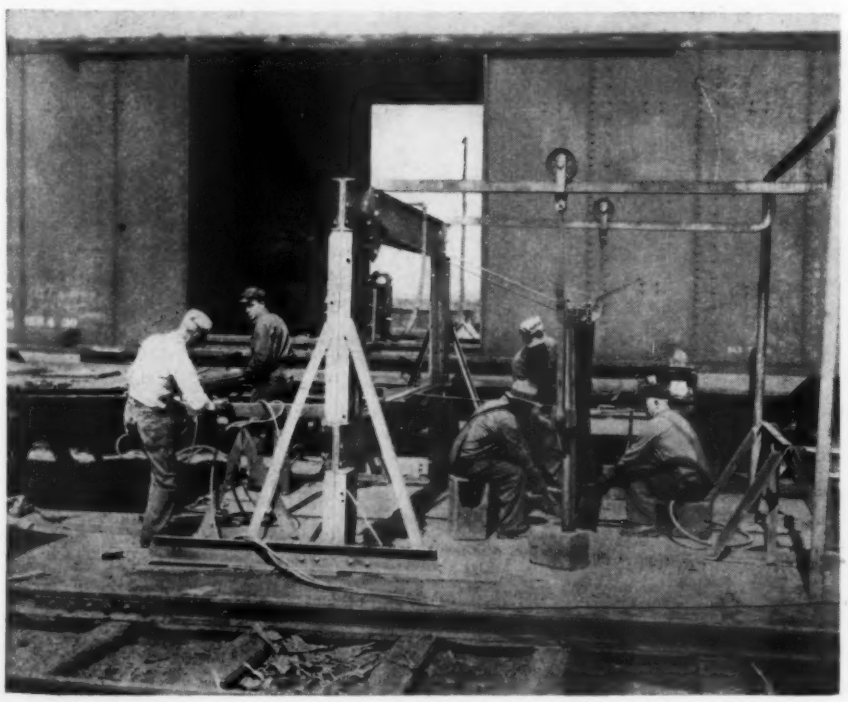
* Concluding paragraphs of a paper presented at the May 15 meeting of the Car Department Association of St. Louis.
† Vice-president, Union Tank Car Company.



Special door jig in use at a freight car repair shop for riveting work—After the doors are assembled they are moved under the uprights and mounted in the frame which has trunnions at the center—The riveting can be done with the door in an upright position and it can easily be turned over

increased production for war needs, and also that so many of our young men have left to answer the call to duty in the armed forces, making it necessary to employ new, inexperienced people in shops and offices. Many of these people are so unfamiliar with tank-cars that they were surprised to learn that a journal box is not a magazine rack, and that ICC-105-A-400 is a class of tank car and not an income-tax form.

However, tank-car operators have taken these difficulties in stride, and, with the splendid co-operation of the Association of American Railroads, the Office of Defense Transportation, the Office of Petroleum Administration for War; the War Production Board and, of course, the life lines of our nation, the railroads, these obstacles have been surmounted and have only served to add to the glory of our achievement in keeping pace with the gigantic demands of wartime transportation.

It is gratifying to be identified with an industry in which the progress of our country and the war is so directly reflected. Every step forward has been matched by improved service rendered by the tank car; and to those who have pioneered and developed this field, we are indebted for their accomplishment, which is now proving its value more than ever before.

Where in prewar days we registered annoyance at the delay occasioned by a train of tank cars blocking the road at a railway crossing, today we wait patiently while a long line of these steel, home-front soldiers speed past, for we realize that the commodities these tank cars carry represent the life-blood that will be transfused into the veins of our giant bombers and battle tanks, as well as the Diesel fuel and lubricating oil that will keep the engines throbbing in our liberty ships which are carrying supplies and replacements to Uncle Sam's brave fighting men and their allies.

Air Brake Questions and Answers

HSC Equipment on Passenger Cars and Diesel A and B Locomotive Units Brake Application

297—*Q.—With this coil energized, what happens?* A.—When the coil is energized its armature and stem is pulled down, thereby seating the lower magnet valve and unseating the upper magnet valve *161a*. Inshot air flows through choke *142*, past upper magnet valve *161a* through passages *17* and *17a* to diaphragm chamber *K*, thus balancing the inshot pressure on all diaphragms.

298—*Q.—With all lower magnet valves closed, what is the effect of additional application pressure?* A.—With all lower magnet valves *161*, *161a*, *161b* closed, additional application pressure from passage *16a* can build up only in diaphragm chamber *A* and act on the smallest diaphragm *60*. As the area of diaphragm *60* is 40 per cent of the main diaphragm *38*, only 40 per cent of the pressure in chamber *A* will be transmitted through the diaphragm stack to the main diaphragm.

299.—*Q.—How, then, is the build up of brake cylinder pressure accomplished?* A.—The application valve *32* and its piston *30* will be held open by lever *43* until brake cylinder pressure in chamber *F* and connected brake cylinders builds up to approximately 40 per cent of chamber *A* pressure, thus balancing the pressure on both faces of the main diaphragm.

300—*Q.—What happens at this time to bring about lap position?* A.—When the air pressure on main diaphragm *38* becomes balanced, spring *42* starts to return the piston *36*, relieving the pressure on the upper end of lever *43*. Springs *33* and *34* then seat application piston *30* and its valve *32*, and through stem *29* pivots the lever *43* at its upper end, holding the exhaust piston *25* and its valve *23* closed, retaining brake cylinder pressure and arresting the return movement of piston *36*. This is lap position in which the relay portion maintains cylinder pressure against leakage.

301.—*Q.—Explain how brake cylinder pressure is thus maintained.* A.—Any reduction in brake cylinder pressure (chamber F), will cause the greater pressure on the left of the diaphragm *38* to again open the application valve *32*, permitting main reservoir or supply reservoir air to flow to the brake cylinders until the balance is restored on the main diaphragm *38*.

302—*Q.—How does the speed governor function when train speed exceeds 20 m.p.h.?* A.—When train speed exceeds 20 m.p.h., the speed governor de-energizes the *L* magnet and spring *162a* seats upper magnet valve *161a* and unseats lower magnet valve *161a*, permitting air from passage *16* to flow through passage *17* and *17a* to diaphragm chamber *K* where it builds up on diaphragm *64*. As this diaphragm area is 60 per cent of main diaphragm *38*, the brake cylinder pressure reproduced in cavity *F* by the relay portion is 60 per cent of that in chamber *K*.

303—*Q.—How does the speed governor function when train speed exceeds 40 m.p.h.?* A.—When train speed exceeds 40 m.p.h. the speed governor energizes the *M* magnet coil, pulling down its armature and stem, which seats upper magnet valve *161* and unseats lower magnet valve *161*, permitting air from passage *16* to flow through passage *18* and *18a* to diaphragm chamber *N*, where it builds up on diaphragm *68*. As this diaphragm is 80 per cent of main diaphragm *38*, the pressure reproduced in connected brake cylinder and chamber *F* by the relay portion is 80 per cent of that in chamber *N*.

304—*Q.—How does the speed governor function when train speed exceeds 65 m.p.h.?* A.—When train speed exceeds 65 m.p.h. the speed governor energizes the *H* magnet coil, pulling down its armature and stem, which seats upper magnet valve *161b* and unseats lower magnet valve *161b*, permitting air from passage *16* to flow through passages *19* and *19a* to cavity *P* where it acts directly on main diaphragm *38*. The relay portion, therefore, reproduces brake cylinder pressure equivalent to chamber *P* pressure and laps off.

305—*Q.—What does the operation of the diaphragm stack as controlled from the speed governor provide?* A.—Provides four braking ratios of 40, 60, 80 and 100 per cent which limits the braking force in proportion to the train speed.

306—*Q.—As the train speed reduces below 65 m.p.h. how does the speed governor function?* A.—As train speed reduces below 65 m.p.h. the speed governor de-energizes the *H* magnet and spring *162b* seats lower magnet valve *161b*, cutting off supply to diaphragm chamber *P*, and unseats upper magnet valve *161b*. The air in diaphragm chamber *P* then flows through passage *19a* and *19*, past upper magnet valve *161b*, choke *138* and passage 15 to inshot chamber *C*, and through passage *15a* to exhaust valve *93*. The air in chamber *C* deflects diaphragm *85* against the tension of spring *88*, moving piston *84* to unseat exhaust valve *93*, opening passage *15a* to exhaust, *EX*. This exhausts the diaphragm chamber *P* to seven pounds inshot pressure, after which spring *88* returns piston *84*, permitting the exhaust valve *93* to be closed by spring *94*. This leaves the medium speed (M) magnet energized, which establishes the 80 per cent braking ratio on diaphragm *68*. The relay portion then operates to make a corresponding release of brake cylinder air.

IN THE BACK SHOP AND ENGINEHOUSE

Improved Sanding Facilities on G. B. & W.

An unusual feature of the improved sand-storage and sand-handling facilities of the Green Bay & Western at Green Bay, Wis., is the provision of covered storage space in conjunction with modern sand-drying equipment and a Ross and White elevated tank and delivery system for supplying dry sand to either steam or Diesel locomotives.

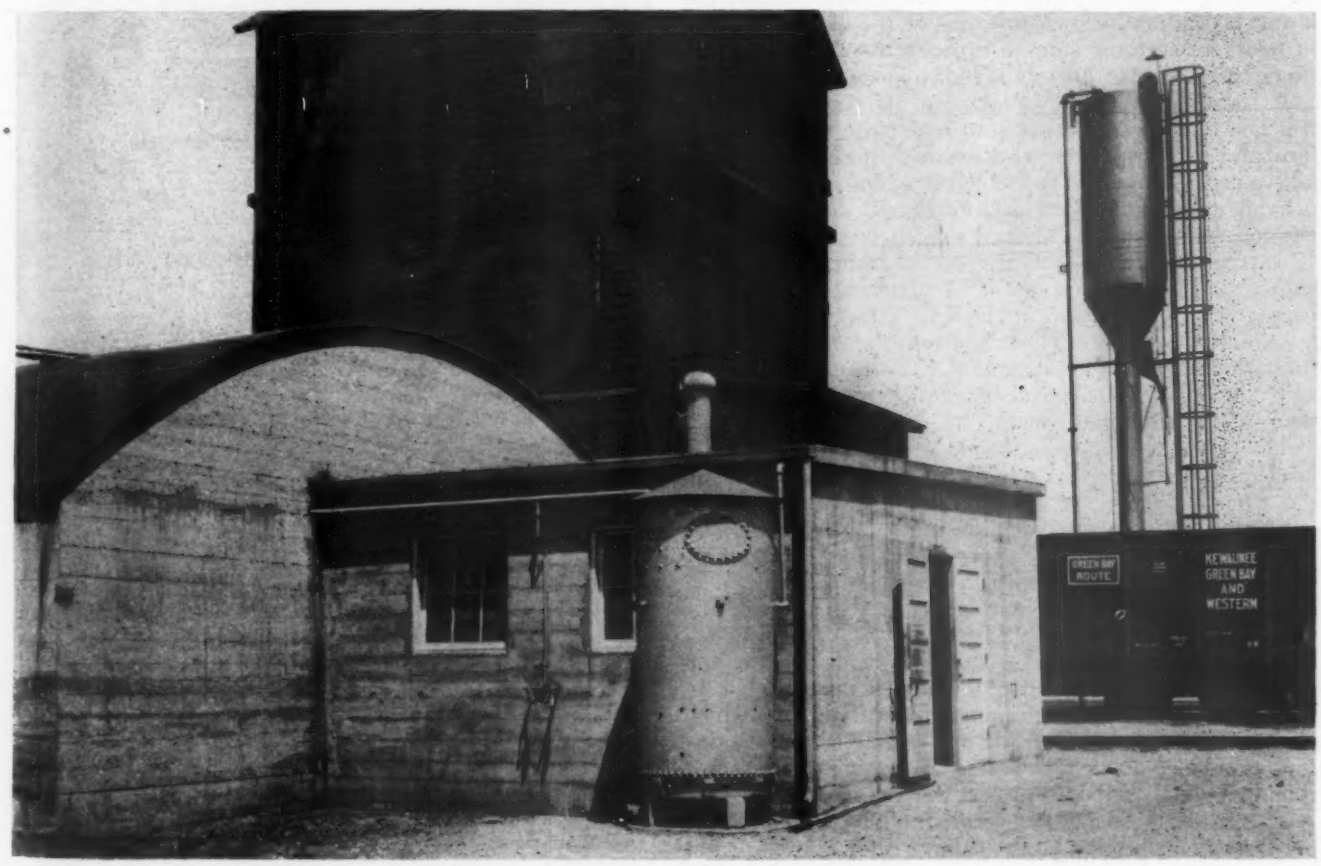
The sand-storage house, a reinforced-concrete structure, 50 ft. long by 30 ft. wide, has side walls 9 ft. high and end walls buttressed for strength and arched to support a six-section, removable truss-hatch roof. The walls of this structure are 6 in. thick, the concrete being poured on footings which extend 4 ft. into the ground. Floor slabs, covering the entire area, are 6 in. thick. The building is divided into three sections by two heavy 12-in. by 15-in. concrete cross beams at the 9-ft. level which are suitably supported by intermediate posts and serve to tie the side walls together, as well as support the main steel roof trusses.

The roof, itself, is made of ⅜-in. by 4-ft. by 8-ft. plywood panels, combined in six units or sections with a U-bolt at the center of each, so that these sections can be lifted one at a time by the locomotive crane and stacked on the ground alongside the sand house while it is being filled with sand transferred from gondolas on an adjoining track by the locomotive crane equipped with a bucket.

The design of the plywood roof is unique in the light but strong construction adopted. The panels in each section are held in alinement and stiffened longitudinally by 2-in. angles with ⅝-in. iron truss rods, and light wood battens unite the panels crosswise and permit them to conform to the contour of the roof. After being placed, each section is keyed in position with easily removable taper steel keys. All joints between individual plywood panels are made water-tight by the application of 4-in. fabric tape sealed with an asphalt paint. The panels themselves are protected by a water-proof paint.

Adjoining the sandhouse proper is a sand-drying house, 21 ft. by 17 ft. by 9 ft. high, also constructed of concrete and built with a slightly inclined flat roof. This part of the structure is well lighted with three six-light windows and it is entered from the outside through a double door. A wide interior door gives direct access to the sand-storage space in the main part of the building. A Pyropad sand-drying stove is installed at floor level, with an 8-ft. square by 6½-ft. deep concrete-lined pit below to accommodate the hopper and dry-sand drum, from which sand is delivered by air through a 2½-in. horizontal pipe under the tracks to the Ross and White dry-sand elevated storage tank, shown in one of the illustrations.

Referring to the close-up view of the Pyropad coal-fired stove, it will be noted that dry sand falls to an inclined ⅛-in. wire mesh screen equipped with two air-operated mechanical vibrators which agitate the screen



Sand-handling facilities on the Green Bay & Western

The concrete sand-storage house, with removable plywood roof, from the rear

and cause fine particles of sand to pass through it while large particles gradually work to the bottom and are cleaned off and disposed of periodically. Surrounding the screen is a non-skid floor plate on which the attendant stands, while firing the stove or shoveling sand from a hand wheelbarrow into the top of the stove. A small air valve near the wall is used to start and stop the mechanical vibrators.

An A. C. F. sand valve, between the floor hopper and the dry-sand drum underneath, is operated by the usual hand-pull lever conveniently located slightly above floor level. With air pressure exhausted from the drum, the sand valve is opened and dry sand permitted to run into the drum until it is practically filled to its capacity of 8 cu. ft. The sand valve is then closed and opening another air valve admits pressure to the drum and forces sand into the delivery line. A booster pipe gives added air pressure to the delivery line when required and the large vertical tank shown just outside the dry sand house provides reserve air storage capacity to prevent fluctuation of air pressure during the blowing operation.

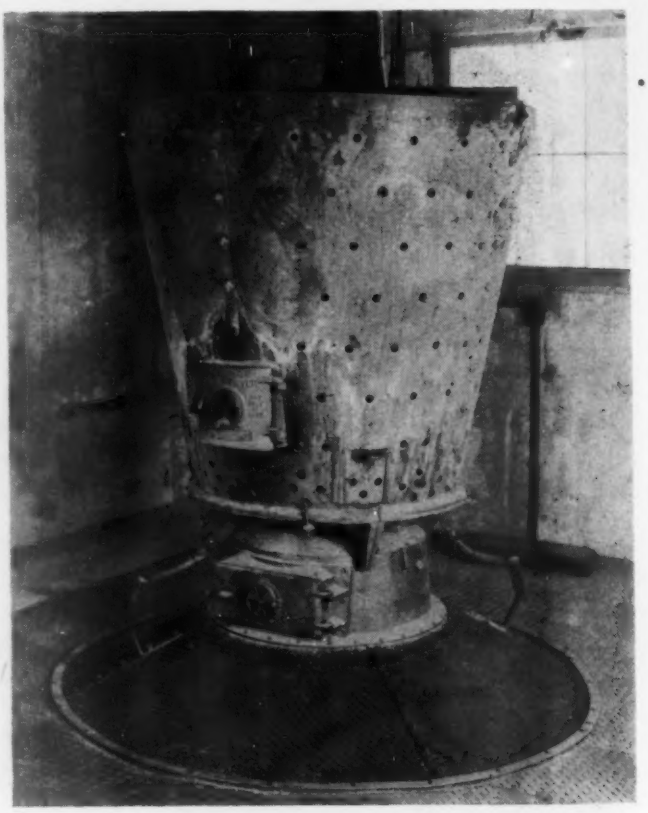
A feature of the horizontal sand delivery line is that it is laid in a covered concrete trough close to the ground level and easily inspected and repaired, if necessary, even where it passes under tracks. Sand is blown through this delivery pipe under the tracks to the R. and W. 10-ton elevated sand tank, mentioned, which is a 5-ft. dia. by 12-ft. tank, mounted vertically on an 18-in. pipe-column support, 26 ft. above ground level. The 2½-in. sand pipe passes vertically upward at the left of the tank as illustrated and delivers sand over and into the top of the tank through a water-tight connection. The usual sand valve and a telescoping balanced spout are provided, with a dome-filling hose on the end.

The height of sand in the tank is shown by a sand level indicator, easily visible to and operated by air by the attendant in the sand house. When filling the tank with sand, it is obvious that the float must not become covered up by the incoming sand, otherwise a false indication will be given. The small flexible wire rope which connects the outside level marker with the float inside the tank passes over a single-sheave pulley at the top which is fully housed to prevent water from entering the top of the tank. One difficulty sometimes encountered in severe cold weather is stiffening of the wire rope which has become wet and frozen. It is proposed to remedy this condition by completely enclosing or housing the indicator rope in a suitable pipe to protect it from moisture.

The ladder which gives access to the sand tank for purposes of inspection and repairs is shown at the right in the illustration, the protective cage being installed around the ladder for purposes of safety.

The new sand-handling facilities on the G. B. & W. have effected a marked improvement as compared with previous practice in which sand was taken from open storage space where it was often covered with snow, completely saturated with water and contaminated with dirt and cinders. Under the new arrangement, two, or possibly three times a year, the roof is removed from one half of the sand storage house nearer the track and about 12 carloads of relatively dry Mississippi river sand are unloaded into the house after which the roof is reapplied.

This sand, which is already fairly dry as well as clean, is then wheeled into the dry-sand house as required and shoveled into the stove with only a single manual handling. Comparatively little additional drying is required and then the dry, screened sand passes into the sand-delivery system ready for use. Absence of moisture avoids the possibility of freezing in the delivery line and a reliable supply of sand is available at all times. It takes



Pyropad stove in the dry room—The screen is equipped with two air-operated vibrators

only about 25 minutes for the stove to dry enough sand to fill the 8-cu. ft. drum underneath and firing and cleaning of the fire once in eight hours is generally adequate. More sand is required for winter operation than in summer and the attendant operates the sand-drying equipment and delivery system frequently enough to keep a good supply in the storage tank at all times.

Torch Cutting of Stainless Steels

Quality production of stainless steels is now possible by the use of the Airco flux-injection system which was perfected jointly by the Air Reduction Company, N. Y., and the Rustless Iron and Steel Corporation, Baltimore, Md.

One of the limiting factors in the economical fabrication of stainless steels has been an efficient production method

Stainless steel being cut on a gas-cutting machine by the use of a flux-injection system

of cutting these alloys with the oxyacetylene torch. The elements which give stainless steels their desirable properties produce oxides, when attempts are made to cut them with conventional oxyacetylene cutting equipment, which freeze and become practically impervious to the action of the cutting flame.

With the introduction of flux-injection cutting equipment, stainless steels containing as much as 50 per cent of alloying elements can be cut as readily as ordinary steels are cut by the conventional oxyacetylene method.

Every effort has been made to utilize standard type cutting equipment with the flux-injection system. The flux-injection unit weighs only about 75 lb. when fully charged and has a 35 lb. capacity, enough flux for five hours continuous operation. For hand cutting, a torch suitably adapted to deliver flux is also available. No special gas lines or similar devices are required.

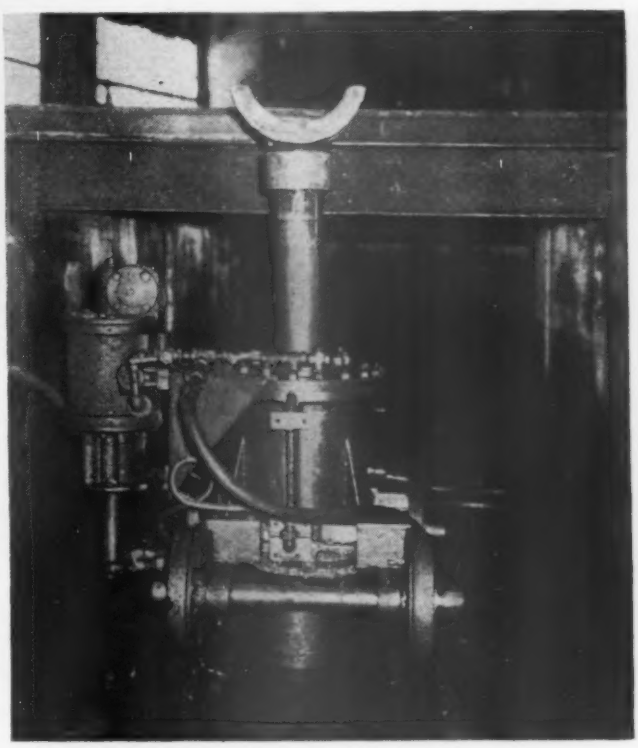
Operating conditions and instructions for stainless steel cutting are approximately the same as required for mild steel, and the speed of the cut is the same for cuts of comparable quality, whether the job calls for machine cuts or hand application. The resultant kerf is also substantially the same and flux consumption for cutting thicknesses from one to five inches averages about one ounce per minute of operation. Only normal preheat, the same as required for standard cutting operations, is required.

The flux used in the process is non-combustible and combines chemically with oxides produced in cutting stainless steels. The relatively inert nature of the flux is an important characteristic which assures trouble-free operation in the injection system and permits long-time storage. The flux flow may be regulated to any predetermined rate by the operator. Simplicity has been stressed in the flux injection and control design to assure constant free-flow in the assembly and to prevent clogging or abrasive wear in the control valves, torch or tip.

Developed originally to cut risers, increased application is foreseen for the process as quality cuts up to 3 in. and rough cuts in considerably heavier pieces up to 6 in. can be effectively made in the more popular stainless steels such as 18-8, 18-8-3, 18-12-3 and 25-12.

Converted Pit Jack

A pit jack at the Princeton, Ind., enginehouse of the Southern which is used for compressing spring rigging has been increased in capacity by the addition of a 9½-in. air pump converted for hydraulic operation. The jack formerly had a 30-ton rating but is now rated at 100 tons and has ample capacity for its intended work without any supplemental jacking or blocking. The photograph



A pit jack, the capacity of which has been increased by the use of an air pump converted for hydraulic operation

shows the unit as it appears now with the changeover made. A 1⅜-in. hydraulic cylinder is used on the pump and the speed of operation is controlled through checking the inlet and outlet ports.

Locomotive Boiler Questions and Answers

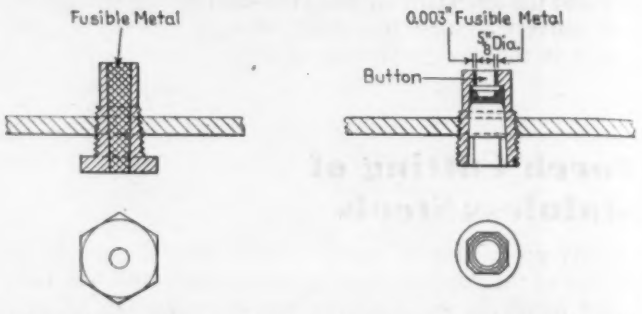
By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Boiler Plugs

Q.—What is the difference between a fusible plug and a drop plug.—C. S. M.

A.—A boiler drop plug is a fusible plug. A common type of fire-actuated fusible plug is shown on the left in the drawing. This type of plug has a tapered hole filled with a fusible metal which melts out when the crown sheet becomes overheated and allows steam and water to enter the firebox. A drop plug is a type of fusible plug which apparently derives its name from its construction. A drop plug is shown on the right in the drawing. It consists of a button cemented in place on the plug body with a fusible metal. When the fusible metal melts the boiler pressure forces the button out of the hole instantly and a full unrestricted opening for steam and water is thus obtained.



* * *

MISION NORTEAMERICANA DE FERROCARRILES EN MEXICO

MANUAL

para la

SOLDADURA Y CORTE

con

SOPLETE

MEDIANTE LOS SISTEMAS DE OXI-ACETILENO

Y

ARCO-PLASTICO (Eléctrico)

INFORMACION GENERAL

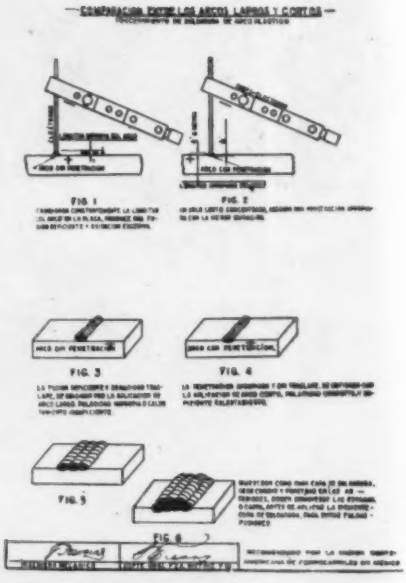
Y

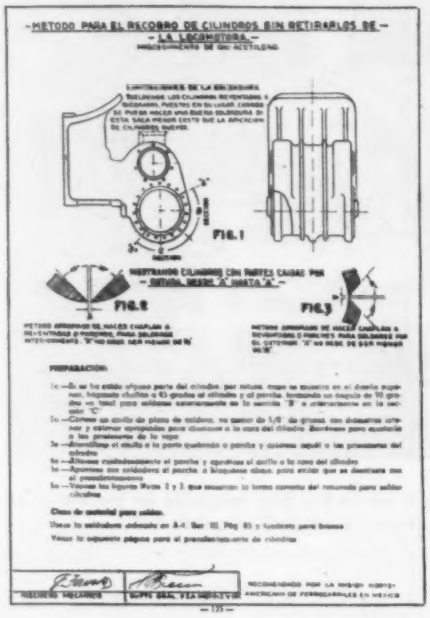
METODOS REGLAMENTARIOS

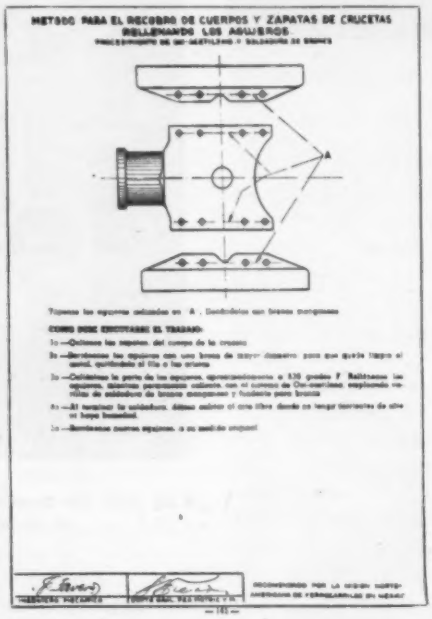
SOLDADURA Y CORTE POR EL PROCEDIMIENTO OXI-ACETILENO Y ARCO PLASTICO (ELECTRICO)

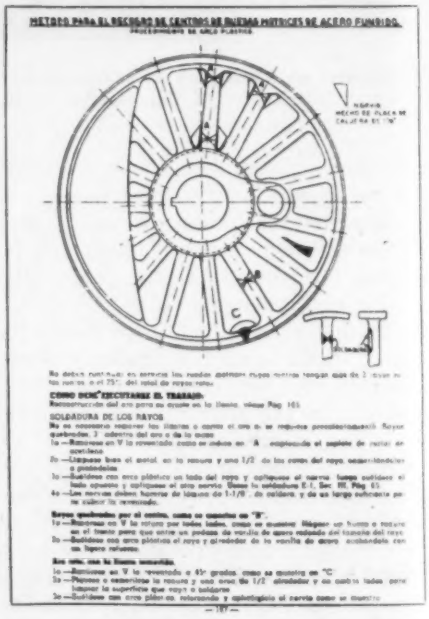
SECCION I.

INFORMACION GENERAL




METODO PARA EL RECOBRO DE CILINDROS SIN RETIRARLOS DE LA LOCOMOTORA


METODO PARA EL RECOBRO DE CUERPOS Y ZAPATAS DE CRUCETAS RELLENANDO LOS AGUJEROS

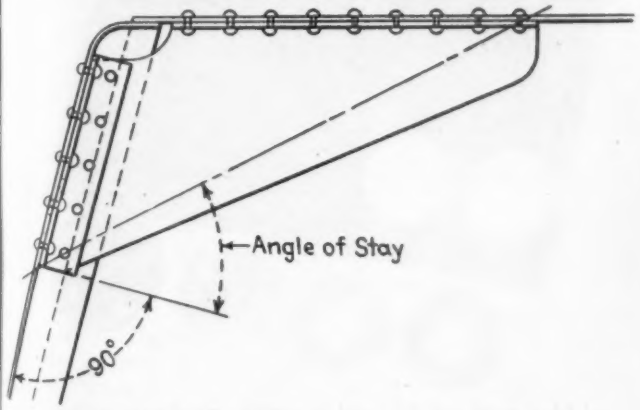

METODO PARA EL RECOBRO DE CENTROS DE RUEDAS MOTRICES DE ACERO FUNDIDO

Sample pages from the manual governing the use of welding and cutting processes on the National Railways of Mexico—The 341-page manual was prepared on the recommendation of the United States Railway Mission in Mexico—J. W. Boyd, formerly with the Baltimore & Ohio and the Western Maryland, is the supervisor of welding with the Railway Mission

Strength of Backhead Braces

Q.—In computing the strength of gusset braces for the backhead of a locomotive boiler, should any consideration be given to the angularity of the brace, as is done with the rod type of brace?—M. E. F.

A.—In calculating stresses for stays and their attachments, the angularity of the stays, if in excess of 15 deg. must be taken into account, irrespective of the type of brace used. The practice in calculating stresses on braces is to take the entire area supported by the stays, multiplying by the boiler pressure and dividing by the sum of the smallest sectional area of all the braces. This method is satisfactory if the braces are uniformly spaced. If one or more of the braces are set apart so as to receive more than a proportional share of the load they must be calculated separately. Gusset braces are calculated separately



Method for obtaining angle of the stay for gusset braces

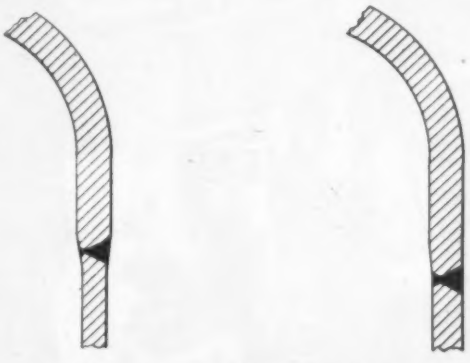
from rod braces when both types are used to brace the same surface.

The angle of each stay must be ascertained and if it is in excess of 15 deg. the area of the stay must be reduced by multiplying the area of the stay by the cosine of the angle the stay makes with a line drawn at right angles to the area supported.

Butt Welding Plates Of Different Thicknesses

Q.—When butt welding the head of a drum to the shell, if the thickness of the head is greater than that of the shell, should the edges of the head be scarfed down to the same thickness as the shell before welding?—M. O. F.

A.—The recommended practice in cases where plate edges of unequal thickness are to be joined is to trim the

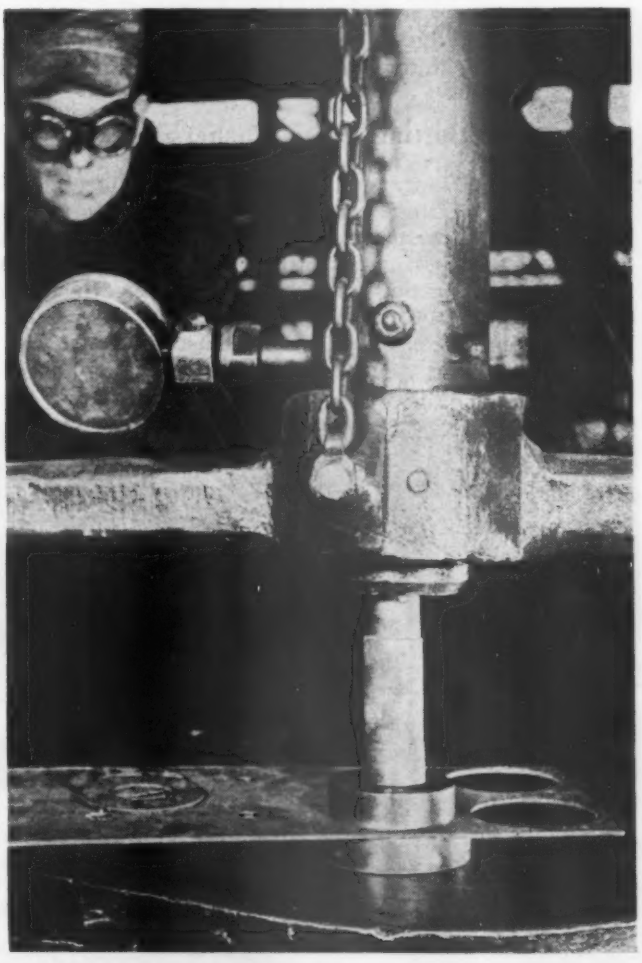


Left: Preferred method of tapering. Right: Permissible method with taper on one side of plate only

edge of the thicker plate to a smooth taper extending for a distance at least four times the offset between the abutting surfaces, so that the adjoining edges will be of approximately the same thickness. The length of the required taper may include the thickness of the weld. The preferred method is to reduce the thickness of the heavier plate by removing metal on each side. Doing this keeps the center lines of the two plates together. However, it is permissible to remove all material by tapering one side of the plate only.

Illinois Central Shop Suggestions

The Employees' Suggestion System on the Illinois Central to increase shop production and safety has brought out the two suggestions shown in this article from the Paducah, Ill., locomotive shops. Both won awards from



The dies cut fiber washers in a single operation

the railroad and also official recognition from the War Production Board at Washington, D. C.

Applying Reverse Shafts

Locomotive reverse shafts with the arms attached are notably unbalanced and awkward to handle and formerly required several men, working in conjunction with the shop crane truck, in order to apply them. What with the low headroom under the boiler barrel and danger of the unbalanced shaft turning and catching hands or fingers, the application of lift shafts was by no means an easy and safe job. With a view to eliminating the possibility of personal injury and enabling lift shafts to

be applied easier and quicker, the device shown in the illustration was developed.

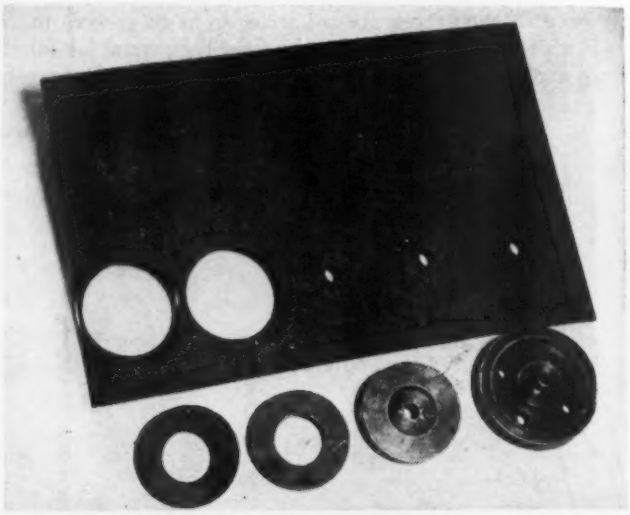
It consists of a 2½-in. steel bar, 10 ft. long with a hook welded to one end and a ring in the other which is easily attachable to the boom of the crane truck at an elevation of about 6 ft. above the shop floor. A sliding link located at about the center of the bar is provided for engagement with the crane hook and the outer or hook-end of the bar is chained to the lift shaft at approximately its center of gravity.

It is obvious, therefore, that with this device, a lift shaft can be taken from the shop floor or storage rack and, by operation of the truck crane, lifted to approximately the desired elevation and pushed in over the locomotive frame and under the boiler barrel simply by moving the crane truck in that direction. One man only is required to keep the shaft from swinging during this operation and, with a light bar leverage at the nearer end of the lift shaft, the machinist can easily keep the link support arms horizontal while the lift shaft is being pushed in over the locomotive frame. It can then be lowered in place in the bearings safely and with minimum manual labor.

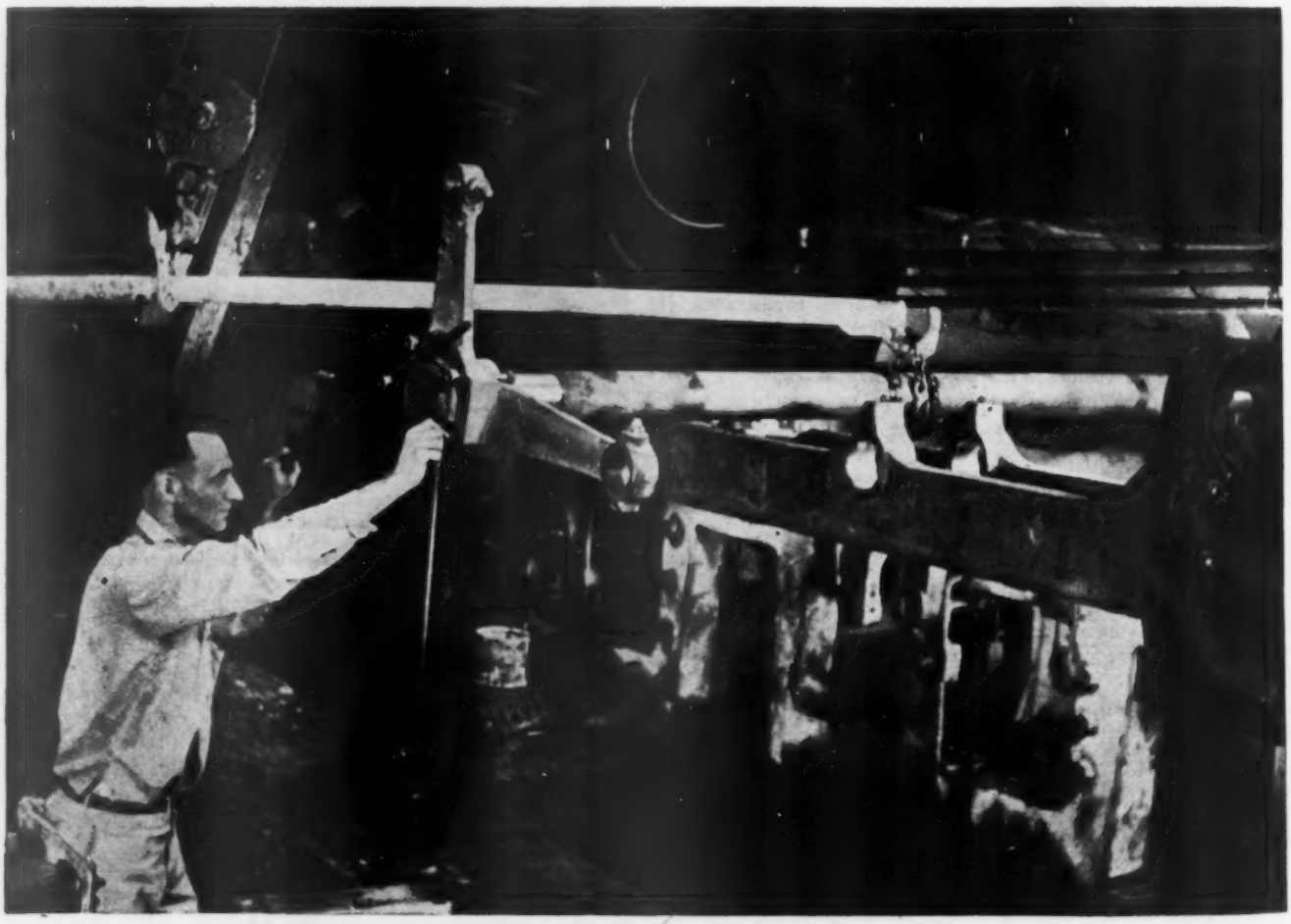
Cutting Fiber Washers

Fiber washers are extensively used on the Illinois Central to take lateral wear in valve motion parts and it was formerly the practice to lay out these washers on squares of the fiber material, then take the squares to a Do-all saw for cutting out the washer, after which the center hole was cut out on a lathe.

The special dies, shown in the illustration, are now used under a press, enabling washers to be cut quickly and accurately and with much less effort than formerly. The punch consists essentially of two case-hardened parts, a base female die and a top male die, suitably positioned with respect to the base by a pilot hole which fits accurately over a round pin in the base. The fiber board is laid out so as to avoid as much waste of material as possible and pilot holes punched in the material as shown in one of the illustrations. With the base die on the bottom, the fiber board is then inserted and adjusted until the pilot hole fits over the positioning pin. The male die is also applied over the pin and a single operation of the punch press illustrated serves to cut out the washer.



Fiber board and dies used in cutting lateral-wear washers



Device used in applying reverse shafts at Paducah locomotive shops

Rewinding Traction Armatures

By N. J. Greene, D. E. Stafford and C. Gentilini

Part II

THE most important factor to be considered in the design, fabrication, and installation of armature and equalizer coils are copper fatigue and insulation deterioration. The number of turns, span, connections, copper size and arrangement, and minimum dielectric requirement of windings are factors fixed for a given set of electrical characteristics. Changed operating requirements or need for modernization may necessitate the altering of one or more of these factors. When such is the case, it is an electrical design problem, and complete design analysis should be made.

Copper fatigue and the resultant wire breakage in armature windings can be attributed to many causes, and there are equally as many devices for countering the supposed causes. There are, however, some fundamentals that must be followed to minimize copper failures.

The basic copper must be of the highest quality and the most fatigue resistant available. Several premium coppers having superior properties are obtainable under various trade names. Soft annealed copper is generally accepted as desirable; any severe strains set up in the copper grain structure by edge bending, swaging, and similar cold working should be relieved by annealing. Surface scratching and nicking the copper must be avoided, as well as excessive pounding while forming the coils.

The above is particularly true at positions in armature windings where vibration and bending forces are concentrated, such as at the leads back of the commutator, at the coil corners near the end of the core, and at the clips or knuckles. Prominent among the several causes of bending forces is the linear expansion and contraction of the copper wire.

Fig. 5 shows the amount of increase in length of an armature coil bar from expansion caused by increased temperature. The dotted loop at the end of the slot portion illustrates coil distortion at a position where a large portion of this increased metal length is relatively free to be relieved. After the armature body has absorbed some heat, the increased copper length relative to the core is then a function of the difference in coefficients of expansion of the copper and the steel of the armature. It is not so much the difference between the coefficients of expansion of the two metals that causes the trouble but rather the wide difference in their temperature. The increase in copper length from expansion relative to the core is greatest when heavy starting currents flow through a cold armature; however, there is a continual variation in coil length during operation, caused by the variable type load on traction motors.

This changing of coil length and resultant bowing of the coil at the end of the slot section not only contributes to copper fatigue but it also disturbs the coil insulation; and the same heat that causes the expansion and contraction accelerates thermal aging of the insulation. In time, flexible coil insulations will be destroyed by heat and movement.

All modern traction armature windings are fabricated with Class B insulation, having an A. I. E. E. (Standard 11) temperature rating of continuous operation at 120 deg. above ambient. Often, higher temperatures are reached in operation, and the best of insulating materials are strained to their limit.

Class B insulation covers a wide variety of combinations of inorganic substances in conjunction with organic bonds and backing materials. Some maintain their flexibility after being subjected to prolonged high temperatures, while others become brittle and lose their ability to withstand movement. The backing materials normally used are organic papers and fabrics; however, in some instances inorganic paper and cloth are used. There are applications where each of the different backings may have advantages. In recent years Fiberglas cloths, some as thin as .00175 in. and .002 in., have proven highly successful for Class B backing materials. Along with the step-up in inorganic content of Class B material, we now have a new heat-stable organo-silicon oxide polymer in the form of varnishes and binders. While too early for exhaustive field tests, the performance to date on traction armature coils is most favorable, and an entirely new line of insulating materials have resulted. The temperature limits of these are in excess of present A. I. E. E. Class B ratings.

Equal in importance to the copper and insulation consideration is the proper installation and physical fit of the armature windings. The size of the slot portions must be held to a very close tolerance and must be correct for a tight drive fit without the necessity of adding filler materials. However, rather than have coils loose in the slot, it is preferable to use even organic fillers, though mica is the normally accepted material. A tight fitting coil may be driven into the slots with less hazard of damage by painting with an insulating varnish just prior to installation. The wet varnish serves as a lubricant and, after it sets, provides a bond between the coils and the core.

The coils must be shaped so that when they are installed, the pre-formed copper will lie in its normal position without setting up strains and binding points.

The point at which the coil slot section leaves the core lamination is hazardous in any winding and is even more so on railway-type armatures. The distortion from ex-

Part I appeared in the August issue.

pansion shown in Fig. 5 and the forces caused by vibration and by inertia of the end windings concentrate combined motion and pressure between the coil and the ends of the core lamination. The slots of many armatures are recessed at their ends to accommodate a U-shaped piece of heavy paper or fabric, thus affording a cushion and method of minimizing strain concentration is to taper core may not have been provided, another effective method of minimizang strain concentration is to taper the core slot from $\frac{1}{32}$ in. to zero inches for about $\frac{1}{2}$ in. back into the core, rounding off the outer edge.

The placement of the various insulations should be executed in accordance with carefully prepared drawings especially for the armature under consideration and made along the lines as shown in Fig. 4.

Banding

A properly cleaned and insulated armature core and the correct use of insulating materials and coils must be complemented by carefully considered banding procedure. The quality of the finished armature may be lowered, unless the same careful planning is given to the banding

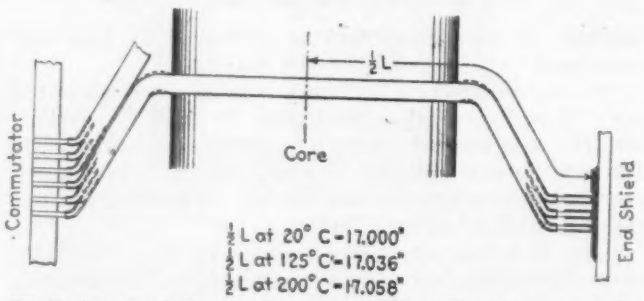


Fig. 5—Increase in length of armature coil bars from copper expansion

method, as has been followed in the other steps of armature rewinding.

To calculate the load which the bands must carry, the usual procedure is to consider as separate problems the stresses in each of three sections of the winding, i. e., the pinion end, the core section, and the commutator and section. The stresses in each of these sections can be calculated by the empirical formula:

$$S = 3.25 \times (1000)^{\frac{rpm}{2}} WD$$

S = stress on the bands in lb.
W = weight of coils, including insulation and band wire in the particular section under consideration
D = armature diameter in inches

(Fore core bands use a constant of 2,8 instead of 3.25.)

After the value of "S" has been determined for each end and for the core section (except when slot wedges are used), a suitable size wire is selected. The allowable tension per wire for the wire size chosen is given in Table I. Divide this value into the stress to get the number of wires required in each band. On coil ends use double deck bands, if necessary, to accommodate the required number of wires.

Steel wire having a tensile strength of 240,000 to 270,000 lb. per sq. in. is generally used for banding armatures. However, to reduce commutation voltage and band losses, a non-magnetic band wire is desirable on higher-speed traction armatures. Non-magnetic, stainless steel wire is used in preference to phosphor bronze because of its greater tensile strength, 225,000 to 256,000 lb. per sq. in., as compared to 130,000 to 150,000 per sq. in. for phosphor bronze. The band wire must be of such quality and toughness that it can be bent 180 deg. on itself without breaking.

The anchoring of the ends of the band wire is most important, and it should be such that it will hold even after the solder may have melted and thrown off. A frequently used method of satisfying this requirement of fastening the band wire ends is shown in Fig. 6 which shows a section and a plan view. This method is principally applicable to bands on the end windings, because core band grooves normally do not have sufficient space for the double, folded-over clip. A good method for applying core bands is, first, to insulate each band groove with a layer of saturated .010-in. asbestos paper, over which is placed a strip of .015-in. tinned copper. Apply the band on the tinned copper strip, using standard, fold-over band clips, and solder to form a solid mass of band wire, copper strip, and clips.

The intermediate band clips are normally made from tinned copper and are usually spaced five or six in. apart, except at the beginning and ending of the band, at which point the clips are placed closer together. The number of clips must be an odd number that is not a multiple of any whole number divisor of the number of poles in the machine or closer than 10 per cent (more or less) of the number of poles.

Temporary "hot banding" is necessary on traction armatures to insure against lack of solidity that may lead to premature failure. Hot banding is accomplished by heating the armature to 250 deg. F. before soldering the leads into the commutator and before brazing coil connection clips where they may be used. A temporary band is run over the hot armature from the commutator riser to the pinion end of the windings. The end windings are protected with a cushioning pressboard strip under the band; and a filler strip of metal, fiber or hard wood is placed in each slot projecting above the slot.

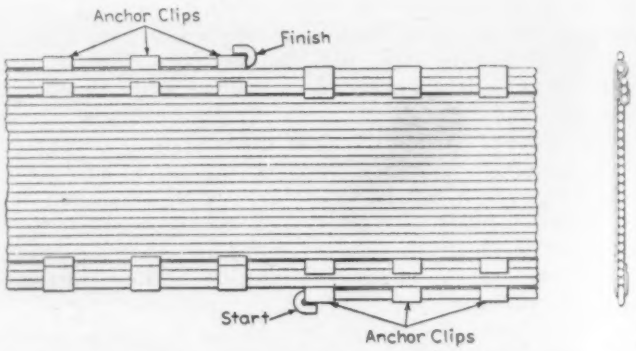


Fig. 6—Plan and sectional view of band wire showing method of anchoring

In the case of a wedged armature, install band clips so that the core portion of the temporary band can be removed for wedging with the end bands in place. After the slot wedges are in and before removing the temporary end bands, solder and braze the windings as required and then dip and bake the armature according to established standards. After the armature has cooled to room temperature, remove the temporary bands and apply the band insulation and permanent bands.

It is very important that the tension be uniformly applied. There are a number of tension devices on the market which control and uniformly apply any prescribed tension, the amount of which should not be a matter to guess. The values given in Table I have proven satisfactory.

Except on phosphor bronze band wire, a high temperature soldering alloy or high tin content solder should be used when possible. Care must be exercised to prevent annealing of the band wire during the soldering process.

and the wire should not be heated to values exceeding those below:

Phosphor bronze	450 deg. F.
Plain steel	600 deg. F.
Non-magnetic steel	1,000 deg. F.

Solders having a liquifaction point higher than 450 deg. F. should not be used on phosphor bronze band wire.

Impregnation

The proper varnish treatment ranks close to the top of the list of those things that may be done to improve the quality of a winding, and yet it is one of the least expensive to execute. Consequently, it would be imprudent to use anything but the highest-grade insulating varnish and the best method for treating and baking.

Most of the varnish manufacturers have a top-grade varnish; and while there may be many formulas for producing such a material, the generally preferred properties are: long life at elevated temperatures; deep-drying ability; only slight resoftening under heat; toughness; resistance to oil, moisture, and chemical attack; good wet and dry dielectric strength; satisfactory viscosity for proper draining and build-up; reasonably safe flash point.

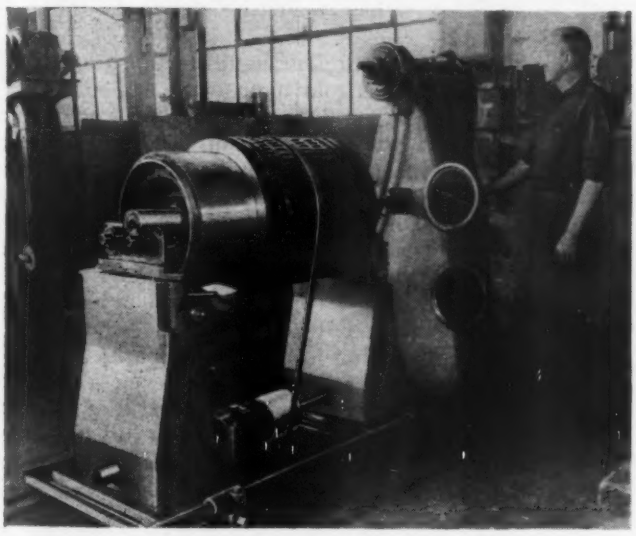


Fig. 7—Traction armature in dynamic balancing machine

Vacuum pressure impregnation is usually accepted as the best method of application for the initial treatment followed by one or two dips. The impregnating cycle may require 10 to 12 hours elapsed time, 1 hour preheat, 3 hours vacuum, 3 hours pressure, and 3 hours draining. During this treatment, the innermost parts of the winding become saturated and coated even though more than half the varnish forced in may drain or "bleed" out during baking. The additional varnish dips fill surface cracks and voids, providing a protective film over the entire winding.

A good impregnation and dip treatment bonds and solidifies the entire winding, resulting in increased heat conduction; sealing out dirt, oil, and other foreign materials; improved and prolonged life of insulation; less damage from mechanical shock, and moisture resistance.

The armature should be baked after impregnation and after each dip in a well-ventilated, preferably recirculating-air-type, oven at from 250 to 275 deg. F. The time, of course, depends upon the drying properties of the varnish, characteristics of the oven, and the physical size of the armature. A typical baking cycle for a 400-hp. high-speed traction armature with 18-in. diameter by 16-in. long core, using a high-grade synthetic varnish of general properties, shown above, is as follows:

1—Preheat in oven one hour at 250 deg. F.
2—Allow to cool to 90 deg. F. before placing in vacuum tank
3—Bake 12 hours at 275 deg. F. after impregnation
4—Bake 12 hours at 275 deg. F. after first dip
5—Bake 18 hours at 275 deg. F. after second dip.

It is usually desirable to permit the armature to cool to approximately 100 deg. F. before each dip. This procedure gives a heavier film build-up and minimizes polymerization of the heat-reactive varnish in tank.

Dynamic Balancing

Traction drives are using higher-speed motors to obtain better efficiency and lighter weight as is evidenced by the increase in peripheral speeds from 8000 to 12,000 ft. per min. during the past 25 years. Motors operating at these speeds must have precision-built, dynamically-balanced rotating members. An unbalanced armature may destroy anti-friction bearings, break armature coil leads, damage gearing, cause bad commutation, and in addition may have undesirable physiological effect.

Modern-designed rotating elements usually have provisions for fastening the dynamic balancing weights, though the methods may vary widely. Some units have grooves on both the pinion and commutator ends into which the counter balancing weights are electrically welded. Others require the fastening of the weight by bolts secured against loosening by lock plates. Practically all traction motor armatures are dynamically balanced by their maker after assembly of the spider, laminated core, and commutator, and before the application of the windings. This minimizes the amount of balancing weights required after the armature is wound and finished. Various types and designs of machines are available for dynamic balancing operations.

Table I—Banding Tension

B&S Gage	Diameter in.	Grade C steel and 18-8 stainless steel, tension, lb.	Phosphor bronze tension, lb.
8	.128	850	600
10	.102	600	400
12	.081	400	250
14	.064	250	160
16	.051	160	100

Fig. 7 illustrates a traction-type armature mounted in a balancing machine for dynamic balancing.

Experience of the operator is a large factor in the quality and cost of the operation, irrespective of the

(Continued on page 409)

Fig. 8—Motor being checked for unbalance with vibrometer

TEST RUN

By
Walt Wyre

THERE had been no official announcement of a Diesel-electric test run from Plainville to Sanford over the mountains by way of Hillside, then across to Minertown and back over the mountains at Summit Pass, but sand-house gossip had been discussing such a run for at least a week. There had been many arguments about the feasibility of using the 5,400 horse-power Diesels over the steep, tortuous ascent of Summit Pass. A majority of the engineers discussing the idea agreed that it would not prove practical, but their opinions are sometimes based on prejudice.

Ned Sparks was moving a light over the engine-crew lineup board in the washroom when the question was being discussed by a couple of engineers. Both hogheads agreed that the Diesels wouldn't do the job, which agreement not being conducive to an argument and thus not satisfactory to engineers, one of them turned to Sparks and said, "What do you think about it, electrician; do you think the Diesels will stand the gaff pulling a drag over Summit Pass?"

"Well, I don't know exactly," Sparks replied, "but in my opinion a Diesel properly handled will pull more load up the hill quicker than one of the Mallets."

"Maybe so," the hogger said, "but what kind of shape will she be in when she gets to the top? They got plenty of power but they haven't got the guts of a steam locomotive. A damned old Mallet will keep puffing and pulling until she stalls, then spin her drivers without hurting anything, but a Diesel will burn her motors up if she stalls. At least that's what my instruction book says," the engineer added.

"That's right, a Diesel electric won't stand being stalled with the throttle open," Sparks agreed, "but I'll stick to what I said at first. If not overloaded and properly handled, the Diesel will take more tons over the hill in less time than one of the 6,000-Class Mallets that they are using."

About that time Jess Wilson, a boilermaker, came into the engineers' washroom. Jess had evidently been listening from the other side of the partition in the shopmen's washroom. The boilermaker dropped his two bits worth into the argument without delay.

"I've worked on steam locomotives over twenty years and ever since the S. P. & W. bought the first Diesels I've been watching them and the Diesels haven't got what it takes for the grind up Summit Pass. What's more," Wilson looked at Sparks as he spoke, "I'll bet you ten dollars if they make a test run the Diesel falls down."

"What do you mean 'falls down'?" Sparks asked.

"Well—" the boilermaker hesitated a moment, "I'll bet you ten dollars they have to set out part of the train if they start up the hill with full tonnage rating or within fifty tons of the rating," Wilson added defiantly.

"I'll call that!" Sparks reached in his pocket for his empty billfold, intending to bluff the boilermaker.

"I haven't got ten dollars with me," Wilson admitted, "but I'll bet you if you'll make it a payday bet."

"It's a bet!" Sparks snapped. "I can use an extra ten bucks payday. We'll just write out the terms of the bet and both sign it."

"How do you know there's going to be a test run?" the engineer asked.

"Well, if there is no test run the bet's off," Wilson said.

THREE days later, Sparks was cutting the mica down on a commutator of an electric welder armature when Jim Evans entered the electric shop. "How much do you lack having that welder ready for service?" the foreman asked.

"Oh, it'll take three or four hours to finish and get it back together," Sparks told him.

"Well, soon as you get the welder finished, you'd better go home and get a little sleep," Evans said. "They want you to go out on a Diesel tonight."

"What's the idea?" Sparks asked. "I'm not supposed to be a traveling Diesel maintainer."

"No," the foreman said, "but you've had considerable experience on them and there's no maintainer available. This is a fairly important run, too," Evans added. "It's to be a test run around the horn."

"What time is it going to get out?" Sparks asked.

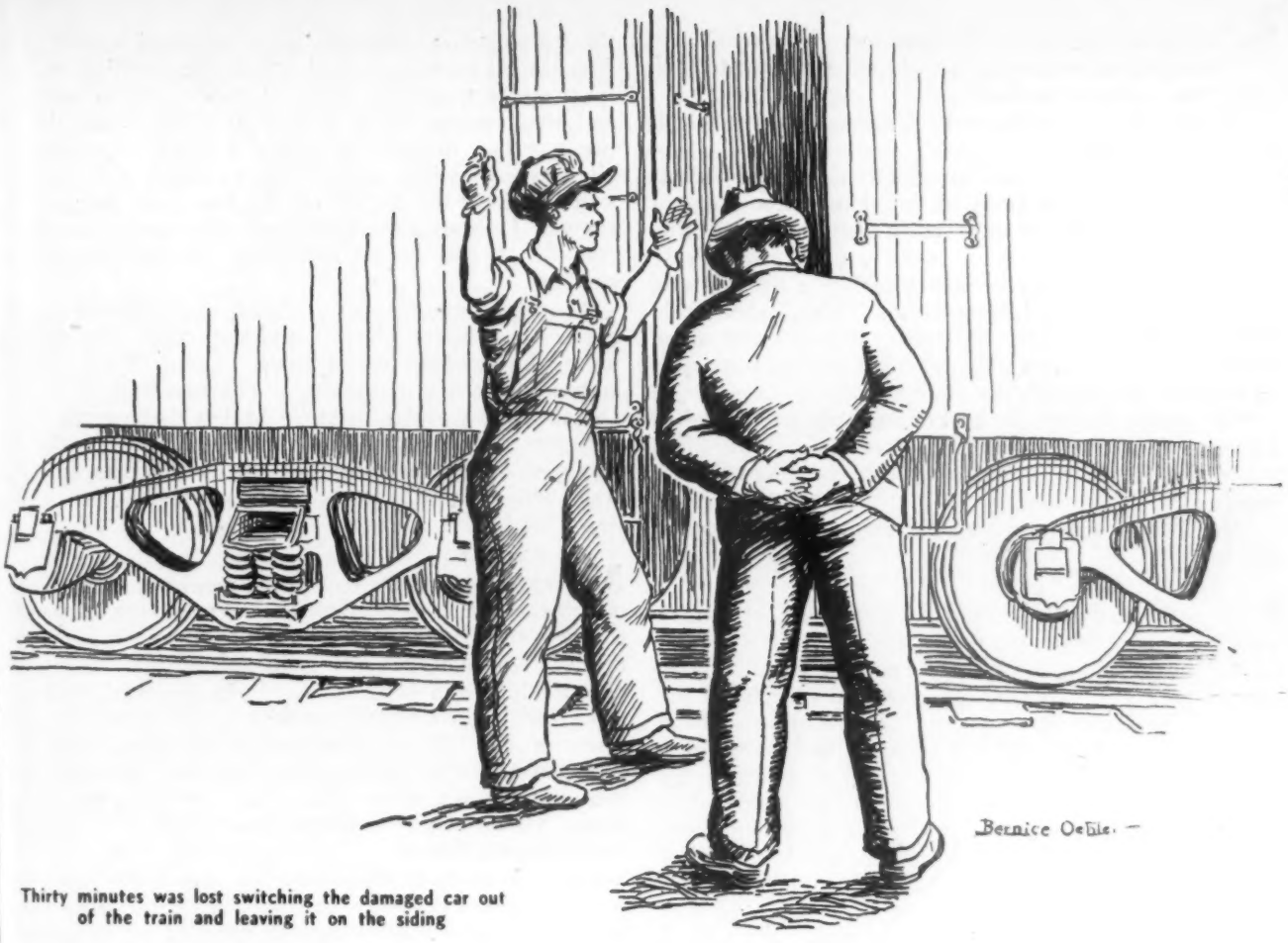
"The train is doped in here about eleven o'clock tonight," Evans told him. "They want to get it out soon as possible. I'll leave word for the caller to call you when he calls the engine crew," the foreman added as he turned to leave the electric shop.

Sparks finished the welder and went home at 2:00 p. m. Not being sleepy, he sat around until about six o'clock, then ate supper and went to bed. Unaccustomed to going to bed so early, Sparks lay there over an hour before he went to sleep. About ten-fifteen, the phone rang. "Called for 11:45 for Diesel No. 951," the caller said.

If Sparks hadn't been sleepy when he went to bed, he was sleepy then. He shook his head and opened his eyes with an effort. Then suddenly raised up and sat on the edge of the bed. The 951—he knew her well—the second oldest Diesel electric freight locomotive on the S. P. & W. and by far in the worst condition? Sparks groaned as he thought of trying to get a load up Summit Pass hill—and the ten dollar bet with Wilson. He could imagine the boilermaker grinning as he took the money.

Sparks dressed in no great rush, got his handbag that was already packed, went to the kitchen for his thermos bottle and started to make some coffee but changed his mind and decided to go to the beanery. He drank a cup of coffee and had the thermos filled for emergency, then walked across the tracks to the Diesel spur where the locomotives are serviced.

Attendants were already filling the fuel tanks. Sparks climbed up into the engine room of the No. 3 unit and placed his handbag on the bench. Before putting on his overalls he walked through the engine rooms and checked the cooling water levels. "Better fill all the water tanks," he told the attendants.



Thirty minutes was lost switching the damaged car out of the train and leaving it on the siding

"How about lube oil?" one of the men asked.

"Haven't checked it," Sparks said. "I'll check the oil soon as I get my overalls on."

Lube oil was low in two of the units and three of the cans used for carrying spare oil were empty. Sparks emptied both of the two full cans into one of the engines and told the men to fill all five cans and bring two more for the other engine in which the oil was low.

"That's more oil than they usually take," one of the men grumbled.

"Well, that's what we need this trip," Sparks told him.

THE run from Plainville to Sanford was made nicely and without any trouble. Leaving Plainville, Sparks made a couple of trips through the engine rooms noting oil pressure, cooling water temperatures, looking at all contactors to see if they were operating properly and generally looking, listening, and sniffing for indication of trouble. He found none and went to the rear cab and climbed up into the seat. Despite the uncomfortableness, he managed to take a little nap. Sleeping in the cramped position made his legs cramp and his neck stiff, but before he slept in bed again Sparks would willingly have lost the ten dollar bet for a chance to stretch out on a comfortable mattress. The run to Sanford was made in two hours and twenty-five minutes, just twenty minutes more than passenger time. Sparks had time for a cup of coffee and a roll while carmen inspected the train. Somewhat refreshed, he went back to the locomotive and climbed aboard.

The engineer was a young fellow recently promoted and none too familiar with Diesel operation. He showed his nervousness by the way his hands moved from one lever to another. When the conductor gave a highball, the engineer released the air, then, without waiting long enough for the brakes to release towards the rear of the train, opened the throttle.

"Better give the brakes time to release," Sparks cautioned.

The engineer didn't reply, but the look he gave the electrician indicated no appreciation for the suggestion.

At Lakeview they went into the siding to meet a passenger train and troop train. Sparks was in the rear cab when the engineer whistled off. He heard the hiss of air as the brakes were placed in release, then the engine started. Sparks watched the transition meter as the engineer started the train. The indicator hand went over into the red, stayed a moment, then gradually went back to normal position. There was nothing unusual in the behavior of the transition meter, such momentary overloads are usual when starting a train and do no damage.

Approaching the next telegraph station, nine miles from where they had met the two trains, Sparks heard the engineer whistle acknowledgment of a red board. Evidently the board was not lowered, for the engineer whistled again. Then the brakes were applied and the train came to a stop. Sparks walked up to the cab to see why they were stopping.

The conductor was riding the head end and when the head brakeman started to get off, the conductor said, "I'll give that operator a piece of my mind! Come along if you want to hear me bawl him out."

At that moment the operator came out. Before he had time to say anything, the conductor yelled, "What in the hell is the idea of stopping us here at the foot of a hill! A

half-wit gandy dancer would know more than that!"

"Thought you might want to take all your train to Hillside," the operator replied.

"What—!" the conductor exclaimed, as he turned his head to look back.

"Yeah, you ran off and left nineteen cars and the caboose when you pulled out of the siding," the operator said. "The dispatcher says you'd better back up and get them."

The conductor's mouth flew open like a fly trap and stayed that way nearly half a minute. "Well, I guess we'd better go back and get our train. It's so dusty along here I couldn't see far enough to tell if we had them all," he added trying an alibi for fit.

"The gauge showed the brakes were pumped off when I opened the throttle," the hogger said defensively. "Did you notice the gauge in the other cab" he asked Sparks hopefully.

"No, I was watching the transition meter," Sparks told him.

VERY little was said by the men in the cab while they were going back to get the rest of the train. They found a draw bar pulled out, bringing the end sill with it. Thirty minutes was lost switching the damaged car out of the train and leaving it on the siding. That was in addition to over an hour and a half lost stopping and going back.

At Hillside a steam locomotive was put on to help up the hill. It was almost noon and Sparks ate lunch while the train was being inspected and some switching done. The second and third units showed slightly low lube oil and Sparks added ten gallons to each of the units. Engine cooling water was getting low in the No. 3 unit. Sparks filled the unit from the reserve supply tank. It's a hard pull from Hillside to the top of the pass and Sparks wanted everything in readiness.

It was cool in the shade up in the mountains, but the sun was beaming down hot when the train pulled out. The tunnels materially increase heating, particularly of the rear units going up the hill. The fireman is responsible for engine cooling water temperature, but Sparks knew that when he had opened the shutters the fireman would make no further attempt to regulate temperatures and if the engine heat bell started ringing, all further responsibility would be unloaded on the maintainer.

The helper locomotive was doing a fair job of pushing and the Diesel was doing very nicely for its age. Cooling shutters were wide open on the two rear units but when they started through the tunnels, the temperature began to climb. Sparks knew from experience that opening the doors and leaving them open through the tunnels would do little good. Besides, the heat from the front units, dirt and smoke would fill the engine rooms, but opening the doors leaving the tunnels and closing them when entering will materially help to keep the rear units cool. That is particularly true if at the same time the rear cab doors are opened.

About two-thirds of the way up the hill, the rear unit was showing a temperature of almost 200 degrees. The third unit was only about five degrees cooler.

Sparks told the fireman, who replied, "Shutters are all open and I'm not going back there and fan them with my hat."

Sparks started to leave to go back and open the doors between tunnels when the engineer said, "We're going in the hole for a main train at Ozona. The engines can cool off then."

Just as the train pulled into the siding, the heat indicator bell started ringing. The bell continued to ring after the train stopped. Sparks went back and looked at it. The low oil pressure indicator light was burning and the oil pressure gauge had dropped back. The oil was hot and the bearings worn so that at idling speed the oil pressure had dropped to where it would not hold the oil pressure switch open. Sparks threw the isolation switch, taking the engine off the line, then stopped the engine. He waited a few minutes, then started the engine and the oil had cooled sufficiently for the pressure to stay up.

The fifteen minute wait at Ozona was sufficient for the engines to cool considerably and they made it to the top of the hill without any trouble. Going down was of course just a job of braking. The newer S. P. & W. Diesels have variable dynamic brakes that greatly simplify the braking problems, but the 951 was not so equipped. Retainers were set up on the cars and the train had to stop twice to allow wheels to cool going down the hill.

MINERTOWN is at the foot of the mountain below Summit Pass. The smoky little town had been very dead until the war caused many of the shutdown mines to be reopened. Since then many trainloads of coal have gone over the hill from Minertown. Long powerful Malletts, using full boiler pressure on all cylinders, pull the coal trains up the hill. It takes two of them to handle the one passenger train up the grade each day. Since the war increased business many-fold, more trains are routed by way of Minertown and Summit Pass to relieve congestion on the shorter line.

The train yards at Minertown are over a mile from the roundhouse and passenger station. When the train went by the passenger station, Sparks dropped off to go eat. He had just sat down at the counter when the trainmaster came in. "You are riding 951, aren't you?" the trainmaster asked.

"Yes—why?"

"Well, the train is made up ready to go," the trainmaster said. "You are going to delay it a lot waiting to eat."

"Can't help it," Sparks replied. "I've got to eat. Can I get a taxi to take me to the yards?"

"No, but hurry up and eat. I'll get my car and take you out to the yards," the trainmaster said with some irritation.

The engineer taking the engine out admitted that he had done a little running on Diesels between Minertown and Whitesboro, but not much, and the track on that division is practically level. "You may have to show me a little," he said.

The engineer, working cautiously, started the train O.K., made the proper transitions with little trouble, and did a fair job of running to the foot of the pass. There two big Mallets were put on for helpers, one near the middle of the train and one at the rear.

When the train hit the heavy grade, it began to slow down at once. As the speed decreased, the transition meter hand crept over into the red area of the meter. Sparks looked at the speed indicator. It showed slightly under fifteen miles per hour.

"What do I do now?" the engineer asked. "The meter hand is in the red."

"Drop the throttle back a notch," Sparks told him. "Seems like," he added, "that our helpers are dragging their feet."

"We never go up the hill over twelve to fifteen miles an hour," the fireman said.

When the throttle was moved to No. 7 notch the train

slowed down more and the transition meter hand started hunting the red again. The engineer, long accustomed to steam, acted accordingly and opened the throttle. The wheel slip indicator light flashed and the hand went way over into the red and stayed there until Sparks said, "Close the throttle a notch. You're likely to burn up a motor or generator if you don't."

"Don't seem to have much power," the hogger said.

At that instant the alarm bell started ringing. Sparks ran for the engine rooms. The overspeed trip had kicked out on No. 2 unit, killing the engine. Sparks took the engine off the line, started it, then, holding the lay shaft with the tool for that purpose, brought the engine up to speed gradually. Then the engine went to idle and the train slowed to a stop. The next thing there was a jolt that almost catapulted Sparks into the low voltage fuse cabinet. The two helper engineers, not knowing the head end man was going to shut off, had shoved the train up against the Diesel.

Sparks rushed to the front cab. "What's the trouble?" he asked the engineer.

"Just won't handle the load," the engineer told him. "We had slowed down to twelve miles an hour.

THE head brakeman leaned out the cab window and looked back towards the rear end of the train. "Somebody coming this way with a lantern," the brakeman said. "Must be the conductor wanting to know why we stopped. What are we going to tell him?"

"Tell him," Sparks replied, "to tell them hogheads on the helper engine to get the lead out and stop dragging their feet."

The brakeman climbed down from the cab and started walking back to meet the conductor.

"Maybe we had better set out five or six loads," the engineer suggested. "We are not doing any good with this drag."

"That won't be necessary!" Sparks said sharply.

The fireman was watching out the window and saw the two bobbing lanterns come closer together and stop. Then one of them gave a go-ahead. "Highball!" the fireman said.

The engineer blew two blasts of the whistle, released the air, and reached for the throttle.

"Take it easy," Sparks advised. "Don't get in a rush."

The hogger opened the throttle a notch, then another, and another. The train didn't move at once and he started to close the throttle.

"Hold it where it is a moment," Sparks said, and as he spoke the engine started slowly ahead. "Now another notch."

The train picked up a little speed. "Now drop back to the third until we get moving good."

The conductor had evidently told the engineers on the helpers because they cut in and the train went up the hill in fair shape. Two or three times the speed dropped to the point that the transition meter hand was in the red, but never long enough to do any damage. They reached Sanford about two a. m. Sparks had been on duty about twenty-eight hours with just a short nap. His eyelids felt as though each weighed a pound.

Leaving Sanford going towards Plainville, the track is slightly down grade the first twenty miles to Clear Creek, then there is thirty-two miles up hill, but the grade is not heavy. Sparks figured to sleep most of the way from Sanford to Plainville.

After drinking two cups of coffee and eating some, Sparks went to the rear cab of the Diesel and was sound asleep before the train pulled out. Five minutes after he went to sleep, so it seemed to Sparks, although it was nearer forty-five minutes, the fireman woke him up.

"What's the matter?" Sparks asked drowsily.

"Going to have to set out about a fourth of the train," the fireman told him. "There's something the matter with the No. 2 unit. It is not pulling."

"Where are we?" Sparks sat up with a jerk.

"Just crossed Clear Creek about five minutes ago," the fireman said. "Soon as we started up grade the train slowed down and I found the engine not pulling."

"Let's look at it," Sparks said as he slid from the seat.

The trouble was soon located. The rod from the power arm of the governor to the injector racks had broken in the threaded portion right back of a clevis. The indicator plate behind the governor showed the throttle was in the eighth position but the injector racks were in stop position.

"Tell the engineer to keep going," Sparks said to the fireman.

"We can't make it with three units," the fireman said.

"No, but we'll have four units when I get this one going." Sparks picked up the tool used for holding the injector racks and held them in start position and pushed the starter button. Then moving the racks by hand, he brought the engine up to speed. The train picked up speed immediately. All of the way to the top of the grade, Sparks throttled the engine by hand. By watching the hand on the indicator plate he could determine throttle position and move the injector racks accordingly. Already half dead from lack of sleep and almost too tired to stand, it was a nerve racking, man killing job, but he stuck to it and kept the unit working.

When the top of the grade was reached, Sparks let go of the lever and the engine died. He felt almost like doing the same. He staggered through the engine rooms to the cab, legs wobbly, arms aching, and the Diesel roaring in his head.

But he had won ten dollars off the boilermaker and incidentally made a successful run of the test trip.

Rewinding Traction Motors

(*Continued from page 405*)

machine. The tolerance to which the armatures are dynamically balanced affect the cost. The various balancing machines do not have indicators measuring in the same units such as ounce-inches or thousandths-of-inch amplitude. Table II gives limits of unbalance that have proved acceptable. The values in this table are in thousandths-of-an-inch amplitude as measured at the motor bearings. (Amplitude is the extent of the vibratory movement measured from one extreme to the opposite.) The values indicated are applicable when the armature is revolving at maximum rated speed in its own bearings.

Table II—Acceptable Limits of Unbalance

Maximum speed, r. p. m.	Amplitude unbalance at bearings		
	Fair	Good	Very Smooth
600	.004	.0025	.0013
900	.003	.0016	.001
1,200	.002	.0015	.0007
1,500	.0016	.001	.0006
1,800	.0013	.0008	.0005
2,400	.0009	.00051	.0003
3,000	.0006	.0004	.0002
3,600	.0005	.0003	.0002

Checks on the amplitude of unbalance may be made with a simple vibrometer of the type shown in Fig. 8,

which consists of a dial indicator mounted in a heavy base. The heavy base provides high inertia allowing the dial indicator case to remain substantially stationary in space while the indicator plunger is free to follow the linear motion of the bearing. Other types of simple portable indicators are available for these measurements.

When double-deck bands are used, reduce the tension values shown in Table I by 10 per cent for the top band.

CONSULTING DEPARTMENT

Steel or Wood Posts for Lights

What are the relative advantages of steel and wooden posts for supporting lights on platforms?

Climate and Availability May Govern Selection of Material

In deciding on the most suitable type of lighting post for a given platform, a coordination of the economic aspects and aesthetic requirements of the surroundings is necessary. The problem of supporting lighting fixtures on platforms is principally one of support and not one of strength to withstand unusual stresses.

Wood Posts

Wood posts of normal proportions usually have the required strength to support lighting fixtures used on platforms. They are relatively cheaper, lighter, easily fitted and erected. Wood posts of proper kind and structure, properly seasoned and treated against decay periodically with preservative compounds, especially at or near ground level, may last for thirty years or even longer. A concrete footing offers little added protection as compared with erection in soil, as rain and moisture traveling down through and around the wood cannot readily escape especially when shrinkage of the wood due to improper seasoning results in a separation from the concrete allowing the collection of large quantities of moisture. The useful life of a post depends to a large extent on the kind of wood used, nature of the ground, climatic conditions, the time and care taken in seasoning, and the kind of preservatives used and its method of application.

Decay is caused by vegetable organisms known as fungi. The latter require air and moisture at a suitable temperature in addition to food which is provided by the wood substance. A warm humid climate is conducive to decay. On the basis of heartwood resistance to decay, lightness and strength, posts are made of chestnut, cedar, southern cypress, and redwood. In the selection of posts, timber should be chosen that has been felled during the winter months; peeled, trimmed, and allowed to season for a period of at least twelve months; and then kept in a dry condition until painted or impregnated with a toxic preservative compound. Moisture is thus kept out, checking prevented, and the possibility of attack by fungi and insects greatly reduced. Where local conditions allow the use of preservative compounds in place of paint which would give the posts a more presentable appearance, creosote, zinc chloride, copper sulphate, and bichloride of mercury may be used. The application of preservatives by the brush or spray method is comparatively inexpensive but the results obtained are not as satisfactory as with the penetration method.

Steel Posts

Steel posts require a higher initial investment depending on the ornamental embellishments of the design. They are less vulnerable to damage by fires, and may last for fifty years or longer, if regularly inspected and painted when necessary. Dampness of the climate and impurities in the atmosphere of manufacturing and populous districts adversely affect the life span of steel posts. In such surroundings, reasonably longer life may only be expected from steel posts at higher maintenance cost. This added expense may be to an extent as to make the use of wood posts of suitable design advisable. When steel posts are galvanized, the thin coating of zinc will not protect the steel for more than a few years at or near the ground level unless the posts are embedded in a concrete casing extending about twelve inches above ground level.

Concrete Posts

A practically everlasting structure may be built by reinforcing concrete with steel or iron rods if the architectural design of the posts will favorably blend with the rest of the platform design. While a concrete post will generally cost higher initially, it requires no painting and practically no maintenance once it is erected. In estimating the relative costs of the different kinds of posts, the possibility of using concrete posts should not be overlooked.

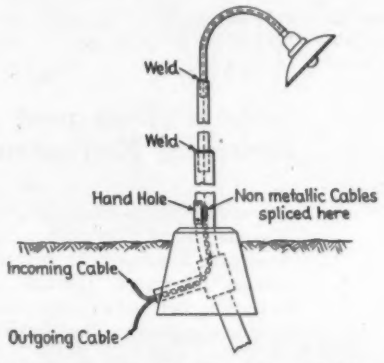
R. G. CAZANJIAN.

Metal Standards Have Inherent Advantages

By far the largest number of platform lighting standards in use are made from metal, but wooden posts have been used in a great many instances. The obvious features of long life and high strength are only two of the advantages obtained by the use of metal standards. Metal standards can and usually are made much more decorative than wooden posts, and they have the advantage of being hollow, thus providing wire raceways. At the present time wooden posts have the advantage of being less expensive and more easily obtainable than metal standards, and in many instances they are quite as satisfactory. This is especially true when they are used at out-lying stations where the decorative effect is not quite so essential.

The safety precaution of proper grounding must be considered when installing any electrical equipment, and platform lighting standards are no exception to this rule. Metal standards are usually placed in a concrete base, which provides excellent support but at the same time acts as a partial insulator between the metallic post and the ground. If the standard is connected to a metallic conduit system, it is automatically grounded, but if service to the standard is by non-metallic underground cable or by an overhead line, the standard should have additional grounding. One way of obtaining this is shown in the attached sketch, where a portion of the metal standard is shown to be extended below the concrete foundation and thus made to act as a ground rod.

The sketch shows a simplified type of platform lighting standard that can be made in any railroad's pipe shop. In normal times a variety of metal standards can be purchased on the market and come ready for immediate installation. However, in some instances it is convenient, though not always economical, to install a railroad made standard.



Proposed design for railroad-built platform lighting standard

Since ordinary wooden poles or posts do not provide a vertical raceway for wires, the service to wooden standards are usually run from post to post as open wires on secondary racks. This type of construction may be undesirable in some locations but it is economical of both labor and material, and thus should be considered whenever a platform lighting job is to be installed.

P. C. FREDKY.

Platforms or Vaults for Transformers

Why are apparently similar sets of transformers sometimes installed in vaults and sometimes on poles or pole platforms? What factors given the choice of installation?

Local Conditions Govern Choice

Prevailing conditions, rather than types of transformers, usually determine location of transformer installations. However, because of the fact that manufacturers often use the same type of cases for transformers having different characteristics, apparently identical transformers may be wound for differing voltages and purposes. Distribution transformers for lights and power are usually mounted on poles or pole racks depending on the size of the transformers used. Sometimes conditions are such that transformer installations for a plant or shop cannot be conveniently located outside because of lack of space or that overhead wires would interfere with operation of equipment such as cranes, derricks, etc. In such cases, installation of transformers in a vault eliminates the necessity for overhead wiring and poles.

Usually, first cost is less expensive when transformers are mounted on poles or pole racks instead of in vaults, but changing out transformers, renewing fuses, and general maintenance is simpler with vault installation.

If considerable current is used, line loss may be a deciding factor in determining transformer location, and it sometimes happens that in such instances pole mounting of transformers near enough to the center of distribution is not feasible.

Line voltages, both primary and secondary, have considerable bearing on how and where transformers will be located. Transformers used for reducing voltage from high voltage transmission lines to a lower voltage for distribution must of course usually be placed outdoors because of safety and impracticability of insulating, except by spacing for extremely high voltage. All of which adds up, as mentioned in the beginning, the manner and location of transformers are usually determined by existing conditions rather than by type of transformer.

W. L. COTTON.

Location of Load Center Is First Consideration

In order to understand why transformers are sometimes installed in vaults, and sometimes on poles, it is necessary to consider all of the factors involved in selecting a transformer location. Transformer locations can not, or at least should not be chosen by the "by guess and by gosh" method. It would be absurd for a railroad that passed through the center of a large city, to locate its only passenger and freight station in the suburbs. Likewise it would violate all rules of electrical design, to install a transformer bank in the suburbs of an electrical load. Therefore, the primary consideration in a problem of this type is the selection of a spot that is as near as possible to the load center. Very often it is impossible to locate transformers at the theoretically ideal place. When calculations are made the actual load center may be found to be in the center of the turn-table or in the middle of the waiting room. Obviously transformers can not be installed in such places, but the nearest practical spot to the theoretically preferred spot should be used.

If transformers are not installed at or near the load center, difficulties such as excessive voltage drop, and high line losses will be encountered.

When the engineer has selected the best available place to put his transformers, it then becomes an easy matter to decide whether to install them on a pole or in a vault. It would be undesirable to mount transformers on a pole, when the pole structure would be unsightly, and it would likewise be foolish to build a transformer vault in the middle of an open field. It is possible to conceive of some instances where either a pole or vault could be used. In these cases, other factors may influence the final decision. One of these factors might be the type of power line that is to be used in connection with the transformers. If an automatic-throw-over switch is to be used so that the transformer bank can be fed from either of two lines, then it may be desirable to provide the additional space and convenience offered by the vault. In some instances it may be found desirable to provide a transformer vault in order to protect the transformer's insulator bushings from the excessive smoke that is often found in the vicinity of engine houses.

Properly installed transformers should require very little service. However in out-of-the-way places, where only one electrician is on duty, the use of a vault will provide an extra safety factor. In the case of the vault installed transformers, it is unnecessary for an unaccompanied electrician to climb a pole that carries a faulty transformer.

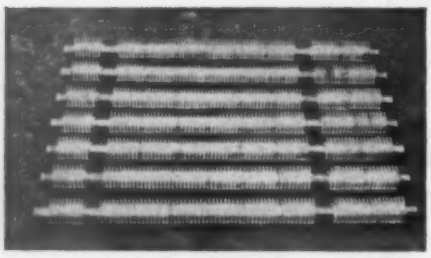
In the foregoing it has been assumed that the transformers in question are of average size, say 15 to 75 kva. Obviously very small transformers would be out of place in an especially built vault, and very large transformers should not be installed on poles.

P. C. FREDKY.

NEW DEVICES

General-Purpose Radiation Units

For some years past, Wilson Engineering Corporation, Chicago, has been furnishing iron directional radiation elements with integrally cast fins, for use in locomotive compressed-air systems, shop bake ovens, and for car-yard compressed-air radiation. This radiation element may be mounted in any position without pocketing of a static ambient air. In some adaptations, for instance, in Diesel-electric locomotives, the weight of cast iron has some disadvantages.



Radiating units made up of copper tubing and finned aluminum sections

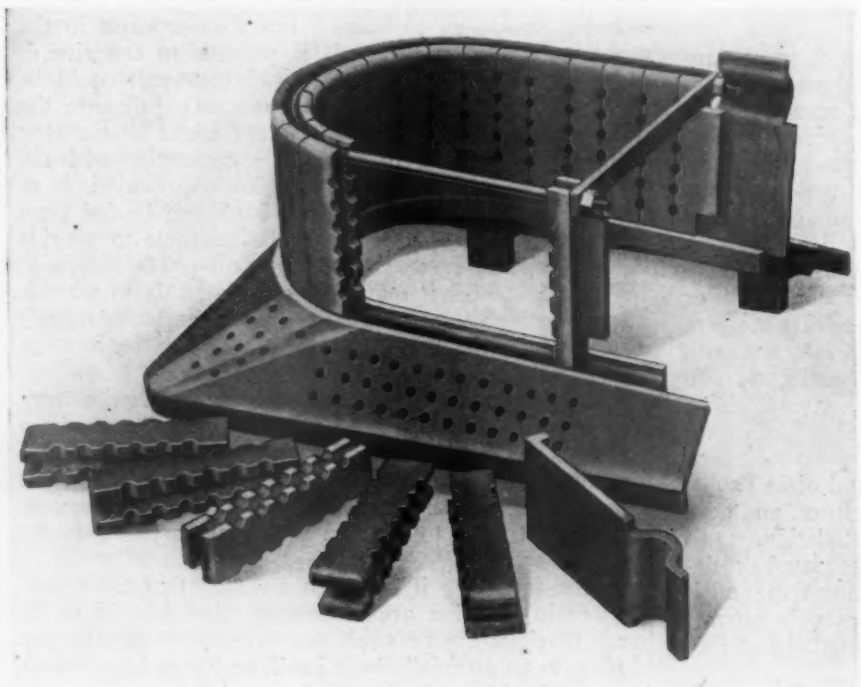
Copper and aluminum are now again available, and a new type, of radiation has been designed and developed by this company, to use these materials, in either high- or low-pressure service. The new radiation elements consist of suitable-strength copper tubing, combined with finned aluminum sections, to provide elements of any reasonable length. These radiation elements do not have the full advantage in vertical installation for radiation to static ambient air of the earlier types, but they are fully effective when installed horizontally. They also lend themselves to use in any position with blown air, as in Diesel-engine jacket cooling or compressed-air cooling.

The new radiation is adapted to the highest pressures required in locomotive practice and is lighter installed than earlier types of piped radiating units.

Sectional Stoker Grate

The Standard Stoker Company, Inc., New York 17, is now furnishing for use with Standard B and MB stokers, a sectional type grate in which only those portions deteriorating due to the heat in the firebox need be replaced when worn. The sectional grate consists of vertical sections which form the upper portion and are supported by shallow right and left base grates which, with few exceptions, can be applied to existing forked or double-center grate frames. The vertical sections are furnished in several lengths to suit the firing heights for different classes of locomotives. They fit into a U-shaped groove in the grate base and when assembled are locked in position by a U-shaped rod. All grate sections except the two at the ends are interchangeable for either the straight or curved sections of the grate.

Air openings in the vertical portions of the grate register with similar openings in the base grates and permit a flow of air to be drawn from the ash pan through the openings into the firebox. This air not only aids combustion, but helps materially and profitably to prolong the service life of the grates.



Breakdown view of parts comprising the sectional-type protecting grates for locomotive stokers

Lubrication and Bearing Refinements

As a result of laboratory research and improved manufacturing methods, the Magnus Metal Corporation, Chicago, has developed a number of refinements in the journal lubricator, journal bearings and motor support and armature bearings made by this company. The capacity of the oil supply to the Magnus journal lubricator has been increased and made more uniform and continuous by improving the fabrication of the lubricating pads and wicking to deliver oil to the top of the cotton-wool pad which has a ¾-in. nap thus assuring a lower running temperature and longer bearing life.

Magnus journal lubricator fabricated to increase the delivery of oil to the top of the cotton-wool pad

New machinery and methods used in the manufacture of journal bearings include (1) an extremely accurate hardness testing machine which assures the rejection of any metal not fully or uniformly up to the requirements, (2) a new type machine for broaching bearing linings, including fillets, to a better, satin-smooth finish. Heat, friction and wear on bearing and journal are thus reduced. In addition, a new method of pressure application of lining metal is being developed which is designed to make a denser and more uniform lining, and assure a much stronger bond between the lining and back of the bearing.

New equipment has been added in order to supply completely finished bearings for motor support and armature bearings in addition to other similar applications.

The quality of journal bearings and locomotive castings is said to be stepped up by (1) improved methods of preparing and handling sand molds, (2) by the installation of new, more efficient sand

(Continued on next left-hand page)

OF PROGRESS

keeping wheels turning

Keeping wheels turning is the job of our railroads. It is a wartime job which is being done outstandingly well as current freight mileage figures keep right on testifying.

The job of chilled car wheel manufacturers is to keep the wheels of *progress* turning . . . to keep developing product improvements without interruption. Setting the industry's pace is the AMCCW, an organization which insists on integrity and demands a high degree of responsibility. Within its membership, leaders in the industry accept — as a condition of good Association standing, the uninterrupted maintenance of increasingly high standards of product quality.

Member companies offer more than lip service to achieve the goal of wheel improvement. As railroad service requirements have increased, new designs have been developed in anticipation of these requirements.

The thoroughness with which standards are upheld can be judged from the seven rigid tests which guarantee uniformity.

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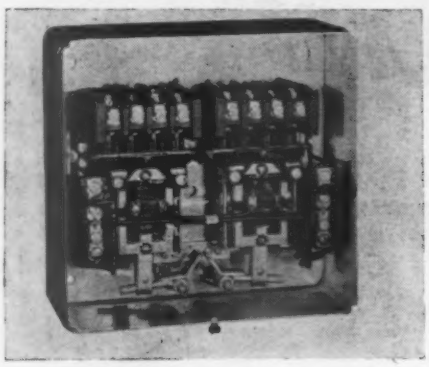
renovating equipment, and (3) by automatic heat control of the solder, babbit and Satco-metal kettles.

Motor Starter With Interlock

An a.c. magnetic reversing starter, featuring a semi-interference-type mechanical interlock, has been announced by the Industrial Control Division of the General Electric Company. Available is size 0 and 1,



The starter is furnished with either a hook-on or a dust-tight and water-tight enclosure

the starter is designed for full-voltage starting of squirrel-cage induction motors, and it can also be used for reversing service when combined with a reduced-voltage starter.

The semi-interference-type mechanical interlock prevents the closing of one contactor while an arc is maintained on the other, thus averting a short circuit through the arc and the resultant burned contacts and blown fuses. In addition, the interlcck arm of the closing contactor assists the interlock arm of the opening contactor in reaching its fully opened position. These interlock arms are case-hardened and their underside faces are buffed and polished to assure long life.

Other features incorporated in this starter are under voltage protection when used with a push-button station or other momentary pilot-circuit device; under-voltage release when used with selector or limit switches; and tamper-proof, self-contained overload relays which allow the motor to operate up to its maximum safe temperature before tripping it off the line.

Quilted Insulation

A refrigerator car insulating material manufactured by the Charles Lachman Company, Inc., Phoenixville, Pa., is prepared from hair fibers, blended and combed into a batt form and sewed between layers of Sisalkraft paper. These insulating mats are not pressed, because the manufacturer's experience has shown that heat conductance is lowest when the hair batting is not compressed. This insulation, known by the trade name Equatemp, has a thermal conductivity of 0.24 to 0.26 B.t.u. per hour, per square foot, per deg. F., per 1-in. thickness. It is said to retain its form and efficiency throughout the car life, without shaking down or otherwise deteriorating.

Vapor Zone Control

The design of post-war passenger cars will unquestionably aim at providing maximum travel comfort for every passenger, and investigations conducted by the Vapor Car Heating Company, Inc., Chicago, indicate that this requires due consideration of the different zones in a car if passengers are to enjoy temperature comfort no matter where they sit in the car.

Temperature zoning takes into consideration the fact that the sunny side of a car may be 8 deg. F. higher in temperature than the shady side. In the heating season, separate thermostatic control on the sunny side of the car and the shady side make is possible for the car heating system to furnish only the exact amount of heat required and thus avoid over-heating or underheating due to the effect of the sun and the shade.

Another zone which affects temperature comfort is at the car end opposite the air-conditioning return grill where cool or cold air may be drawn into the car when the door is opened. This cold air, if drawn past passengers in the first seats of a coach, for example, results in considerable draft at that point; therefore, a separate thermostatic zone in this end of the car contributes greatly to passenger comfort.

The women's and men's lounging rooms, provided for comfort, are entirely separated from the body of the car and thus affected by temperature conditions different from those in the rest of the car. Plainly, the heating temperatures in these rooms must be controlled separately to insure full comfort.

In the past, it has been difficult and somewhat costly to provide the separate zones of heating, but with the Vapor heating system, designed for post-war cars, each additional zone inside the car will be heated by simply running a single radiating unit to the space being controlled and connecting it to a valve operated by a thermostat in that space.

The objective of this development is to supply zone heating which will keep all passengers comfortable regardless of the position which they may occupy in the car.

Journal-Box Packing Waste

The Miller Waste Mills, Inc., Winona, Minn., has developed a journal-box waste, known as Millerpax, which is designed to minimize waste grabs, waste wipes and rolling of packing and to assure the transmission of lubricant to car and locomotive journals under adverse conditions incident to modern high-speed operation.

Using special machinery of Miller design and construction, the new waste is made by three processes combined in one: The first operation removes any foreign matter, including grit, metal, wood, paper, etc., which the manual sorters may have missed; the second subjects the threads to an air-wash which thoroughly removes short ends and lint; the third definitely interweaves the threads into an almost endless mass which is best shown by the accompanying illustration. A new plant for the manufacture of this product is now under construction.

In connection with waste grabs, the interweaving of the new packing tends to prevent small segments of waste leaving the main body of the packing and getting between the bearing and the journal. Waste wipes are reduced by the air-wash process referred to, with removal of practically all free lint and short ends, as easily demonstrated by a comparative dry shake test, assuring uninterrupted flow of oil to all parts of the bearing. The rolling of packing is retarded by the interweaving process which effectively ties the entire mass of waste into one firm body and thus substantially reduces the usual shifting of packing.

This packing has been used by one of the principal rail carriers for the last year in passenger-car and locomotive service and other railroads have made service tests during the last six months. Equipment used in manufacturing the packing is so designed that any railroad specification can be met for all-wool packing, all-cotton packing, or any combination of the two. If resilient fibers are specified they can also be included.

The distribution of Millerpax is being handled by the Nash-Finch Company, Minneapolis, Minn., exclusive railroad sales representative for Miller Waste Mills, Inc.

Long interwoven fibers characterize Millerpax journal-box packing

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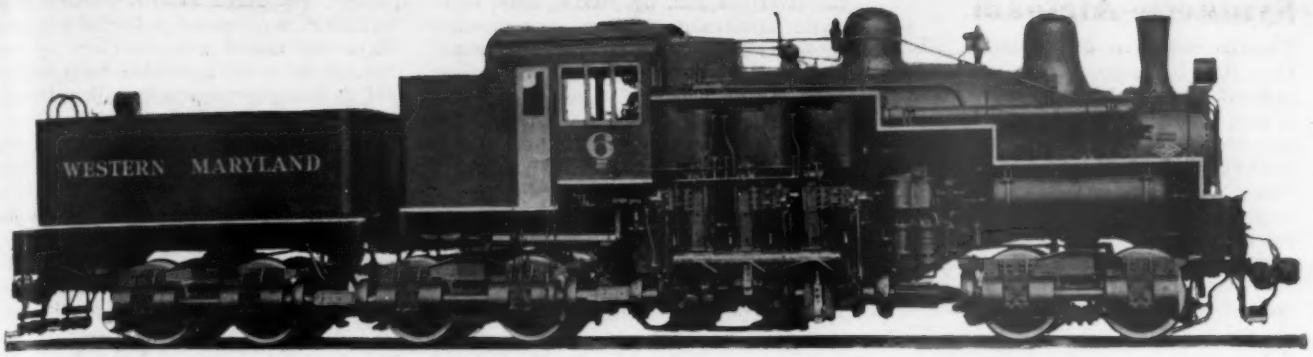


Western Maryland selects Shay

. . . for service on heavy grades

THE Western Maryland Railway has recently placed in service this new Class 150-3 truck Shay-geared locomotive for use on heavy grades and switchbacks in the mountains, supplementing other locomotives of the same type already in operation.

This coal-burning locomotive with a boiler pressure of 200 pounds develops a tractive effort of 59,740 pounds.

An important feature in its construction is that the piston valve cylinders are mounted independently of the boiler, being supported on heavy girder frames.

In addition to its ability to haul heavy loads up stiff grades — operating on some as steep as 10% — this Shay also holds loads on down grades because of its gear drive. It is designed to take any curve on which standard cars can be operated.

It is particularly efficient as a switching locomotive, due to the rapidity with which it can accelerate with a load and its ability to spot cars in minimum time.

LIMA LOCOMOTIVE WORKS LIMA LOCOMOTIVE WORKS INCORPORATED INCORPORATED, LIMA, OHIO

Synthetic Airfoam

The Goodyear Tire & Rubber Co., Akron, Ohio, has been successful in producing a synthetic rubber Airfoam. This material is said to be equal, and in some respects superior, to the pre-war natural rubber product, which was widely used and gave highly-satisfactory service, not only for passenger-car seat cushions and carpet padding, but for crew seats, arm rests, etc., in locomotives.

Among advantages claimed for the new synthetic-rubber Airfoam are greater flex life and aging characteristics and increased

Synthetic Airfoam seat cushions undergoing final inspection

resistance to oil. In one laboratory test of the new foamed latex, it was subjected 250,000 times at a rate of once per second to a pressure which compressed it to 50 per cent of its total thickness. At the end of the tests, the synthetic rubber Airfoam showed no loss in resilience. In another test, latex cushion material was subjected to an aging test for 30 days in a Geer oven at 158 deg. F., again with no appreciable change in the product. Still another test involved placing a section of synthetic rubber Airfoam in an "air bomb" at 260 deg. F. and at 60 lb. air pressure. Even under these conditions, the synthetic rubber product resisted any tendency to change shape or become hard, soft, or tacky.

Synthetic-rubber Airfoam is adaptable to the many sizes and shapes required for seat-cushioning purposes on different railroads, although standardization to some greater degree than at present would have a definite tendency to reduce manufacturing costs and the price to consumers. The fact that cushions can be produced in any thickness and shape desired eliminates the need for spring or other types of support between the foamed latex and the ventilated plywood or metal sheeting to which it is usually applied. The compression, or load-carrying capacity of the material can be varied by controlling the amount of air combined with the latex in mechanical whipping and thus secure any hardness desired within a fairly wide range.

Foamed latex cushions trend to dampen out any vibration transmitted through the car structure and, by making easy, automatic adjustment to every contour of a passenger's body, permit complete relaxation without sense of strain or fatigue even on long journeys. The material also contributes to comfort by carrying off heat and moisture in forced-air circulation through the cell-like structure.

Motor-Alternator For Passenger Cars

The Westinghouse Electric Corporation, Pittsburgh 30, Pa., has developed a motor-alternator designed for use on railroad passenger cars to convert direct current into alternating current for fluorescent lighting and other appliances operating from a.c. power such as electric razors, water coolers, and Precipitrons. It is an entirely self-contained unit arranged for mounting on the car underframing and has been designated as the Type XF-21 Motor Alternator.

The unit converts the nominal 64-volt, d.c. car power into 118-volt, 60-cycle, 3-phase a.c. power. When operating in this service its performance is said to be: Continuous rating, 4,200 volt-amperes with a d.c. supply voltage ranging from 55 to 90 volts; frequency regulation, approximately plus or minus one cycle from no load to full load at any constant d.c. supply voltage between 55 and 90 volts; approximately plus or minus two cycles over the full operating range from no load to full load with variation in the d.c. supply voltage from 55 to 90 volts; a.c. voltage regulation, allowable voltage variation is from 110 volts minimum to 125 volts maximum when operated from 55 to 90 volts d.c. supply and at any load up to full load; and nominal speed, 3,600 r.p.m.

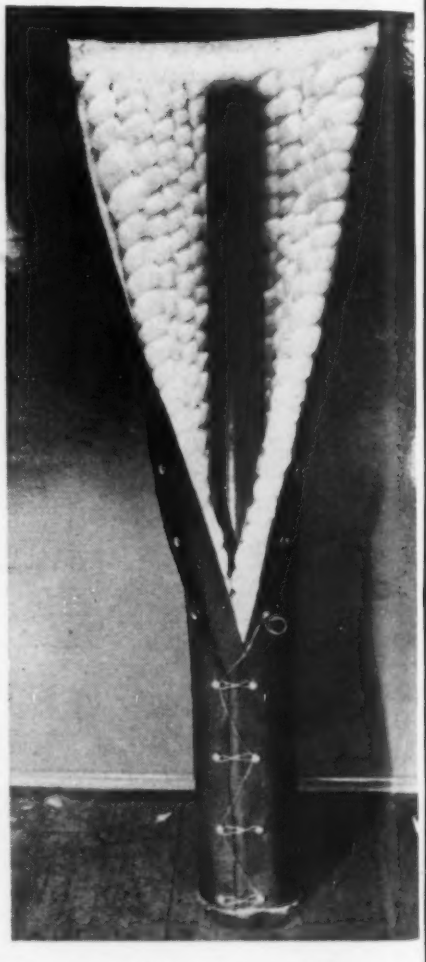
The construction of the motor-alternator includes those basic features which have been demonstrated to be essential for satisfactory operation in railroad service. The operating speed of 3,600 r.p.m. allows a considerable saving in weight, compared with a slower-speed unit. All rotating parts are balanced to insure smooth operation, freedom from vibration, and long life. Provision is made for flexible mounting. The brushes and brush-holders are arranged for ready access. The two ball bearings which carry the two armatures are oversized and arranged to gun-type lubrication.

The a.c. voltage and frequency-control apparatus furnishes rectified alternating current for varying the fields of the motor and generator. The control consists of three small transformers, three copper-oxide rectifiers, and three resistor tubes. A small Spencer-type thermostat disk, similar to those used in electric flat irons, is mounted in the motor-generator set and shorts a resistor when the set attains a near normal temperature to correct the speed and frequency for temperature change.

Pipe Insulation

An insulation designed particularly to meet the harsh service conditions encountered by steam train lines, on locomotive tenders and underneath passenger cars has been developed by the Gustin-Bacon Manufacturing Company of Kansas City, Mo. The product, announced as G-B Flexible Pipe Insulation, is composed of special Fiberglas fibers and coated asbestos cloth so constructed as to be applicable to curved as well as straight-run pipe on railroad equipment.

The Fiberglas fibers are fabricated into a rope-like roving, spirally bound with glass twine and fastened longitudinally to the asbestos jacket. This resilient Fiberglas provides high, permanent thermal efficiency and the rope construction permits easier, more flexible application to pipes and supplies a more uniform insulation at all points, with a saving of approximately 20 per cent in weight. Fiberglas, being impervious to deterioration from rot, moisture or heat,



Fiberglas and asbestos are combined to make this pipe covering

will maintain its efficiency under all operating conditions. It is designed to withstand the impact and abrasion of flying ballast. Under severe road service it will not sag or shake down.

The durable asbestos cloth jacket is waterproofed on the outer surface. Longitudinal sealing flaps with a 1-in. overlap at one end of each 3-ft. section assures a moisture-tight assembly. Strong nickel-plated hooks, securely fastened to the jacket, supply a quick application to the pipe by lacing with copper wire. The insulation is reclaimable and can easily be removed and re-applied. It is available for pipe or tubing ranging in diameter from ¾ in. to 4 in. and is regularly furnished in 3-ft. sections in a standard thickness of 1 in.

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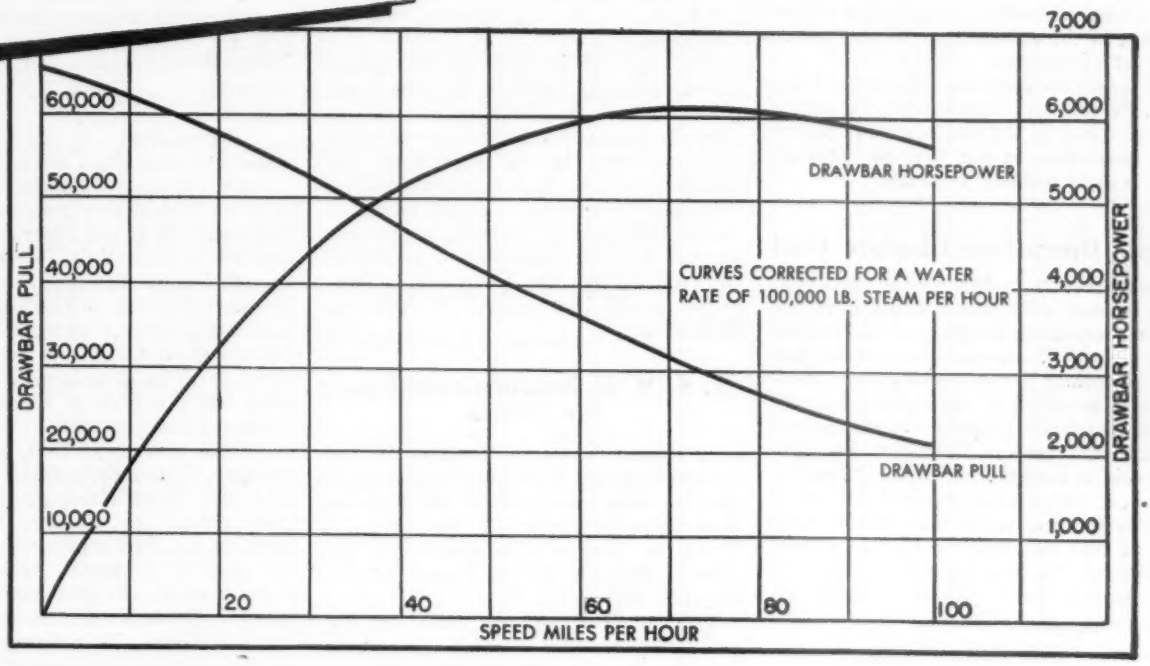
DRAWBAR HORSEPOWER

The Franklin System of Steam Distribution

applied to

The Pennsylvania Railroad's T-1 Locomotives



"The T-1 locomotive developed a maximum of 6100 drawbar horsepower, which is 46 percent more than that of any other locomotive ever tested on the (Altoona) plant. * * *

"The T-1 locomotive was designed to haul a trailing load of 880 tons on level tangent track at a speed of 100 m.p.h. This requires a horsepower at the rear of the tender of 2980. If wind and engine and tender truck resistances are deducted from the drawbar pull shown in the graph, it is found that the T-1 locomotive develops 4100 horsepower at the rear of the tender at 100 m.p.h., which is about 38% greater than necessary to meet the requirements."

Quotation from paper by Ralph P. Johnson, Chief Engineer of the Baldwin Locomotive Works, read before the New York Railroad Club, May 17, 1945.

FRANKLIN RAILWAY SUPPLY COMPANY, INC.

NEW YORK • CHICAGO

In Canada: FRANKLIN RAILWAY SUPPLY COMPANY, LIMITED, MONTREAL

NEWS

Welding Officers and Chairmen To Meet at New York, Oct. 18

THE American Welding Society will hold a meeting of the national officers, the board of directors, and committee chairmen in New York, at the Hotel Pennsylvania, on October 18, to deal with matters requiring official action. This group also will present the society prizes, medals and other awards which have been given at opening sessions for outstanding contributions in the advancement of the science and art of welding.

Although the annual meeting is not being held, the program committee of the society has arranged for the presentation of papers and discussions in the Welding Journal, the society's monthly magazine.

Diesel Operations Displace Coal

DIESEL-ELECTRIC locomotives produced 1944 service units which would have required "something in excess of 12.4 million tons of coal" if the equivalent service had been performed by coal-burning steam locomotives, according to calculations included by the Interstate Commerce Commission's Bureau of Transport Economics and Statistics in a recent issue of its "Monthly Comment on Transportation Statistics." Figures for this year's first four months indicate that the Diesels are off to a 1945 performance for the duplication of which coal burners would require "roughly 18 million tons" of coal.

Illinois Central Plans Lightweight Refrigerator Car

A LIGHTWEIGHT type of refrigerator car which, by the use of collapsible bulkheads, can be transformed into a box car in a matter of minutes, will be built and tested by the Illinois Central within a short time.

One of the special features of the new car is the fact that when completed it will weigh approximately 14,000 lb. less than the standard refrigerator car of today. It will be constructed of aluminum alloys for lightness and will be completely insulated with Fiberglas. It will be equipped with built-in fans for an effective cooling circulation of air from the floor through the ice-boxes to the ceiling, plus air-ducts for protective cooling of sidewalls and better distribution of air over and around the load. The fans also will assist in directing the air circulation when the car is in use with heaters to handle freight that requires protection against cold. There will be a double thermometer on the outside of the car that will show the inside temperature at top and bottom.

Collapsible ice-boxes, which will fold back as reinforcements for the ends of the car when used for other purposes will add approximately 6 ft. to the inside loading length of the car when in ordinary merchandise service. The total inside length at that time will be about 39 ft.

The car will be equipped with steel wheels and hollow axles. The trucks will be designed for smoothness in riding, using longer springs and built-in stabilizers in the truck bolsters. To prevent damage from horizontal shocks, the Duryea cushion underframe will be used.

The floor racks of the car will be of aluminum instead of wood for greater cleanliness, sanitation and non-retention of odors in handling foodstuffs. Synthetic rubber will be used in place of felt to seal the ice-loading hatches.

The car will be built in the Illinois Central shops at McComb, Ill., and is expected to be ready for testing about October 1. Construction will be based on plans perfected by the refrigerator car committee of the United Fresh Fruit & Vegetable Association. Collaborating in the arrangements for building and testing the car are the Aluminum Company of America and the Car Construction Committee of the Association of American Railroads.

A. S. M. E. Nominates Officers for 1945-46

D. ROBERT YARNALL, president of the Yarnall-Waring Company, Philadelphia, Pa., has been nominated by the National Nominating Committee of the American Society of Mechanical Engineers for the office of president of the Society for the year 1945-46.

Regional vice-presidents named by the committee to serve two-year terms on Council are A. R. Stevenson, Jr., staff assistant to the vice-president, General Electric Company, Schenectady, N. Y.; Samuel R. Beitler, professor hydraulic engineering, Ohio State University, Columbus, Ohio, and J. Calvin Brown, attorney at law and mechanical engineer, Los Angeles, Calif. Nominated regional vice-president for one-year terms are Rudolph F. Gagg, assistant to general manager, Wright Aeronautical Corporation, Paterson, N. J.; Edward E. Williams, general superintendent of steam plants, Duke Power Company, Charlotte, N. C., and Linn Helander, professor of mechanical engineering and head of the department of mechanical engineering, Kansas State College, Manhattan, Kans. Directors-at-large nominated to serve four-year terms on Council are Edgar J. Kates, consulting engineer, New York, and J. Noble Landis, assistant mechanical engineer, Consolidated Edison Company, New York.

To be continued in office for the remainder of their terms are Alton C. Chick, assistant vice-president and engineer, Manufacturers Mutual Fire Insurance Company, Providence, R. I., and Thomas S. McEwan, regional director, War Production Board, Seventh Federal Reserve District, Chicago. Messrs. Chick and McEwan have been redesignated regional vice-presidents. Also continuing on Council to serve two-year terms as directors-at-large are Daniel S. Ellis, vice-president in charge of manufacture, Lima Locomotive Works, Lima, Ohio, and Arthur J. Kerr, general sales manager, Pittsburgh Equitable Meter Company and Merco Nordstrom Valve Company, Tulsa, Okla. John E. Lovely, vice-president and chief engineer, Jones & Lamson Machine Company, Springfield, Vt.; David Larkin, vice-president and general manager, Broderick & Bascom Rope Company, St. Louis, Mo.; Samuel H. Graff, director of the Engineering Experiment Station, Oregon State College, Corvallis, Ore., and James M. Robert, dean, College of Engineering, Tulane University, New Orleans, La., continue on Council as directors-at-large for one-year terms.

(Continued on next left-hand page)

* * *

Army railroaders dedicate German locomotive to Gen. Gray

In recent ceremonies at Kassel, Germany, the first of 18 captured 2-10-0 German condenser-type locomotives was christened "Gen. Gray's Gull," for Brig. Gen. Carl R. Gray, Jr., director general of the Military Railway Service. The general is here shown addressing officers and enlisted men, while Col. William S. Carr, (in helmet) commanding officer of the 708th Railway Grand Division, and Lt. Col. John W. Moe, C.O. of the 757th Railway Operating Battalion, look on.

Availability IS HIGHER

with Security Circulators

To help maintain the high standard of performance of Northern Pacific's big 4-6-6-4s, each of them is equipped with eight Security Circulators.

Compared with other locomotives, those with Security Circulators are available for continuous operation for longer periods because they have cleaner flues, longer arch life, and improved combustion, so that boiler maintenance is substantially reduced.

These advantages are in addition to an improved circulation of water over the crown sheet and in side water-legs.

AMERICAN ARCH COMPANY, INC.

NEW YORK • CHICAGO

SECURITY CIRCULATOR DIVISION

Under a recent change in the Constitution of The American Society of Mechanical Engineers the Council is now organized to provide for eight regional vice-presidents to be elected for two-year terms and eight directors-at-large to be elected for four years. Each vice-president will be the leader in his region and will be the representative of that region on Council. He will be responsible for the successful functioning of the Sections and Branches in his area and for the administration of national programs that affect the regions. The directors-at-large will be chosen from among outstanding men in engineering regardless of residence.

Depreciation Rates G. M. O. Equipment

EQUIPMENT depreciation rates for the Gulf, Mobile & Ohio are among those prescribed by the Interstate Commerce Commission in a new series of sub-orders in the general proceeding, Depreciation Rates for Equipment of Steam Railroad Companies. The total ledger value of G. M. & O. equipment is given as $14,022,866, while the ledger value of leased equipment is $124,579.

The depreciation rates prescribed for G. M. & O. equipment (except streamlined passenger trains) which was formerly owned by the Gulf, Mobile & Northern are as follows: Steam locomotives, 4.12 per cent; freight-train cars, 3.64 per cent; passenger-train cars, 5.4 per cent; work equipment, 3.49 per cent. Rates on equipment formerly owned by the Mobile & Ohio are: Steam locomotives, 14.06 per cent; freight-train cars, 9.39 per cent; passenger-train cars, 11.23 per cent; work equipment 12.28 per cent; other rates on equipment owned are: Diesel-electric passenger locomotives, 6.58 per cent; Diesel-electric switching locomotives, 4.78 per cent; freight-train cars, 3.7 per cent; streamlined passenger trains, 6.53 per cent; work equipment, 6.41 per cent; miscellaneous equipment, 24.36 per cent. Rates on leased equipment are: Steam locomotives, 7.48 per cent; freight-train cars, 4.56 per cent; work equipment, 8.53 per cent.

Orders and Inquiries for New Equipment Placed Since the Closing of the August Issue

LOCOMOTIVE ORDERS

Road	No. of locos.	Type of loco.	Builder
Virginian	5	2-8-4	Lima Locomotive Works

FREIGHT-CAR ORDERS

Road	No. of cars	Type of Car	Builder
Alton	40	8-wheel caboose	American Car & Fdry Co.
Baltimore & Ohio	1,000	50-ton hopper	Bethlehem Steel Co.
	500	50-ton hopper	Ralston Steel Car Co.
	500	50-ton hopper	Pressed Steel Car Co.
Clinchfield	300	50-ton box	Mt. Vernon Car Mfg. Co.
Detroit, Toledo & Ironton	200	70-ton covered hopper	Greenville Steel Car Co.
Louisville & Nashville	400	50-ton box	American Car & Fdry Co.
	200	50-ton auto.	American Car & Fdry Co.
	1,000	Hopper	Pullman-Standard
	400	50-ton box	Mt. Vernon Car Mfg. Co.
St. Louis-Southwestern	250	50-ton box	Mt. Vernon Car Mfg. Co.
Pere Marquette	200	Automobile	Ralston Steel Car Co.
	100	70-ton covered hopper	Greenville Steel Car Co.
Western Maryland	40	70-ton cement hopper	American Car & Fdry Co.

FREIGHT-CAR INQUIRIES

Baltimore & Ohio	350	70-ton cement
Canadian National	300	50-ton refrigerator
Chicago, Rock Island & Pacific	1,000	50-ton automobile
Denver & Rio Grande Western	200	70-ton ballast
	25	70-ton covered hopper
Chicago & North Western	800	70-ton gondola
Southern Pacific	1,600	50-ton box
	750	50-ton automobile
	200	50-ton gondola
	550	50-ton drop-bottom gondola
	250	70-ton hopper
	150	70-ton covered hopper
	50	Caboose

PASSENGER-CAR ORDERS

Road	No. of cars	Type of Car	Builder
Alton	15	Coaches	American Car & Fdry Co.
Chesapeake & Ohio	2*	Streamline stainless-steel trains	Ed. G. Budd Mfg. Co.
Missouri Pacific	53	Streamline cars	American Car & Fdry Co.

PASSENGER-CAR INQUIRIES

New York Central	...	Baggage and sleeping

* For service between Washington, D. C. and Cincinnati, Ohio. The trains will be powered by a new type of coal-burning steam-turbine electrically driven locomotive, three of which are now under construction.

Rock Island Has Roller-Bearing Box Car

On August 15 the Chicago, Rock Island & Pacific made a one-day display of its first Timken roller-bearing equipped, lightweight box car at the Union station in St. Louis, Mo. The car, which was designed by the Reynolds Metals Company and built by the Mt. Vernon Car Company, is constructed of the same alloy from which B-29 planes are made, and with the roller bearings and specially designed trucks, is capable of being operated at unusually high speeds. It was also said that the use of roller bearings on the axles makes possible major reduction in starting resistance.

* * *

C. P. R. Photo

Canada's first aluminum-sheathed box car

Weighing 4,200 lb. less than a steel-sheathed car of similar capacity, the box car shown was built by the Canadian Pacific at its Angus shops, in Montreal. Sides, doors, roof, running board, brake steps and hand-brake housing are of aluminum. Two more such cars were built for the C. P. R. by the Canadian Car & Foundry Co., Ltd.

Equipment Installations and Orders

CLASS I railroads put 21,948 freight cars in service in the first six months this year, according to the Association of American Railroads. In the same period last year 15,431 freight cars were installed. Those put in service in the first half of this year included 9,352 box, of which 8,765 were plain and 587 were automobile box cars; 3,561 gondola, 7,215 hopper, 380 flat, 1,133 refrigerator, 220 stock, and 87 miscellaneous cars.

Class I roads put 315 new locomotives in service in the first six months of 1945, of which 52 were steam and 263 were Diesel-electric. Locomotives installed in the same period last year totaled 494, including 190 steam, one electric, and 303 Diesel-electric.

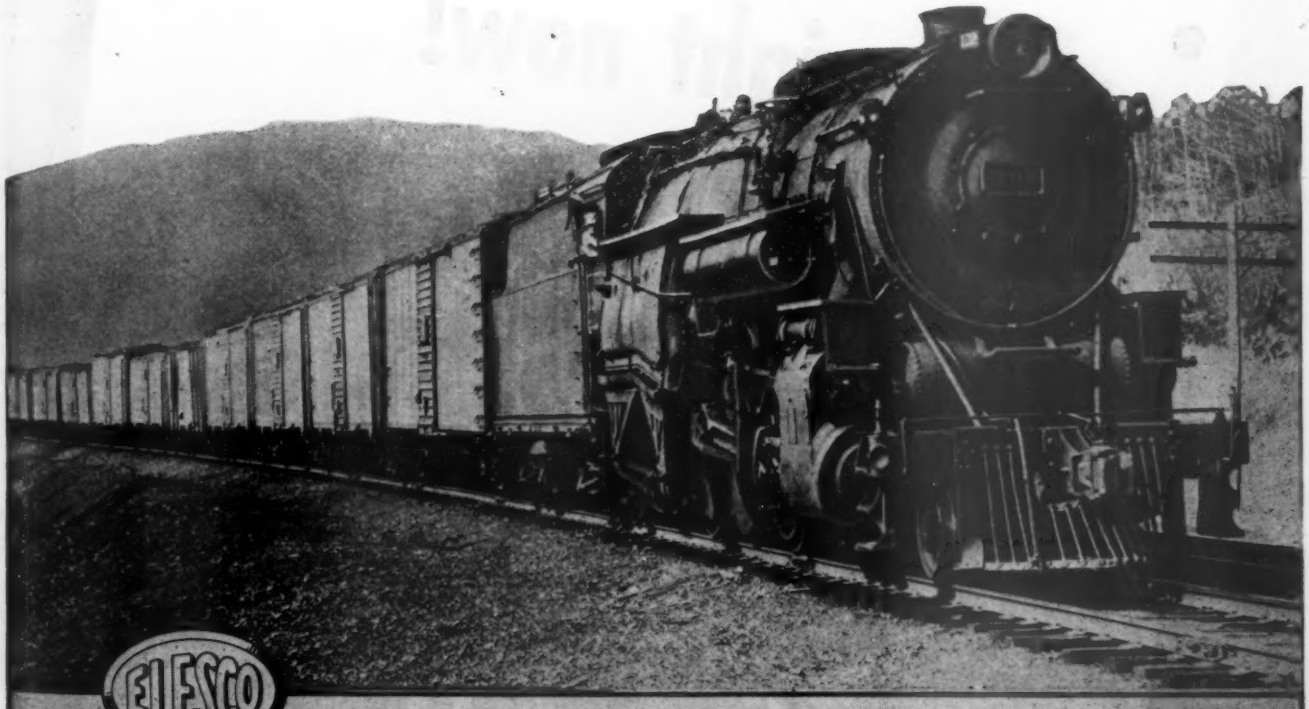
New freight cars on order on July 1 totaled 29,402, compared with 41,236 on July 1, 1944. The former figure included 18,914 box, of which 16,524 were plain box cars and 2,390 were automobile box cars; 4,425 gondola, 3,625 hopper, 932 flat, 1,437 refrigerator, 19 stock, and 50 miscellaneous freight cars.

Also on order on July 1 of this year were 508 locomotives compared with 581 on the same day in 1944. The 1945 total included 111 steam, two electric and 395 Diesel-electric, compared with 179 steam, two electric and 400 Diesel-electric one year ago.

(*Turn to second left-hand page*)

Something *Can* Be Done About It...

The boiler capacity of the older locomotives can be substantially increased by the application of Elesco exhaust steam injectors... the feedwater heater that provides the highest heat reclamation of any feedwater heater per unit of weight and cost.



ELESCO

SUPERHEATERS • FEEDWATER HEATERS
AMERICAN THROTTLES • STEAM DRYERS
EXHAUST STEAM INJECTORS • PYROMETERS

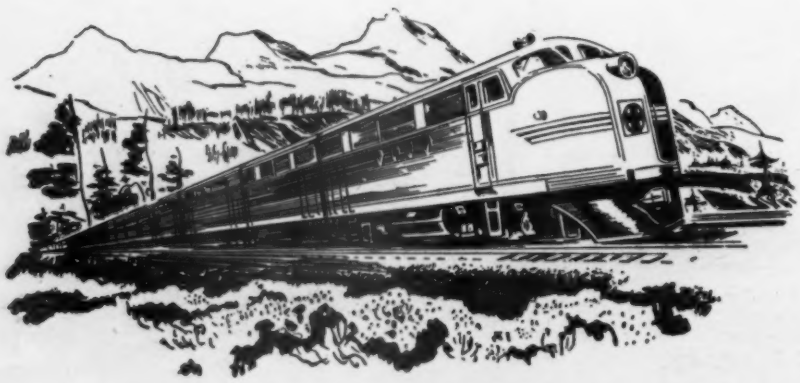
THE SUPERHEATER COMPANY

Representative of
AMERICAN THROTTLE COMPANY, INC.
60 East 42nd Street, NEW YORK
122 S. Michigan Blvd., CHICAGO

Montreal, Canada
THE SUPERHEATER COMPANY, LTD.

IT'S A GREAT NEW DAY FOR RAILROADING

It's doing as well— or better— right now!



GENERAL MOTORS
LOCOMOTIVES

The Santa Fe operating
between Winslow, Ariz.
and San Bernardino, Cal.
goes through some mighty
mountainous terrain—
YET

A General Motors Diesel
freight locomotive
between April 1941,
and January 1945
operated 460,485 miles
with 85.7% average availability.
Average miles per month—
10,233.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS CORPORATION LA GRANGE, ILL.

Supply Trade Notes

SCHAEFER EQUIPMENT COMPANY.—*The Frank B. Nugent Company,* St. Paul, Minn., has been appointed representative in the northwest territory of the Schaefer Equipment Company, Pittsburgh, Pa.

◆

WEATHERHEAD COMPANY.—*J. F. Campbell* has been appointed chief development engineer, *Ralph Erskine* assistant development engineer, and *R. W. Phillips* laboratory director of the Weatherhead Company, Cleveland, Ohio. Mr. Campbell joined the Weatherhead Company earlier this year. He had previously been director and chief engineer of the Fuel Injection division of the Holley Carburetor Company, Detroit, Mich. Mr. Erskine has been a member of the company's development engineering staff and Mr. Phillips joined the engineering staff in 1941 and was appointed in charge of the hose division.

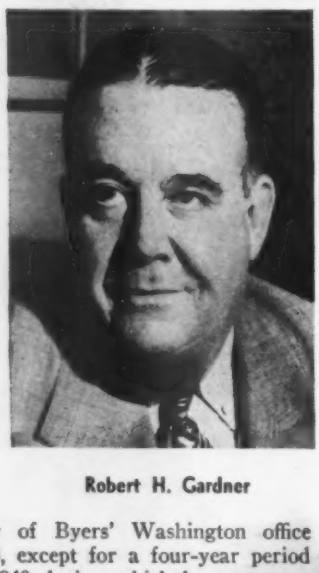
◆

ELECTRONIC LABORATORIES, INC.—*William W. Garstang,* vice-president and general manager, has been elected president of Electronic Laboratories, Inc., Indianapolis, Ind., to succeed *Norman R. Kevers* who becomes chairman of the board. *Walter E. Peek,* sales manager, *Paul H. Frye,* chief engineer, and *Harry C. May,* works production manager, have been appointed vice-presidents.

Electronic Laboratories, Inc., has announced four new manufacturer's representatives. *Harry B. Segar* will represent the company in Buffalo, N. Y.; *Arthur Rocke* in New York; *S. K. McDonald* in Philadelphia, Pa.; and *J. Y. Schoonmaker* in Dallas, Texas.

◆

A. M. BYERS COMPANY.—*Robert H. Gardner* has been appointed general manager of sales of the A. M. Byers Company to succeed the late Myron J. Czarniecki. Mr. Gardner has been manager of Byers' Washington office since 1933, except for a four-year period ended in 1940 during which he was manager of the company's steel pipe sales, with headquarters in Pittsburgh, Pa. Prior to joining Byers, he was assistant sales manager of the Caterpillar Tractor Company.



Robert H. Gardner

H. R. Rowland has been appointed assistant general manager of sales of the Byers Company. Mr. Rowland joined the company's sales department in 1915. He was appointed manager of the Pittsburgh division in 1925 and manager of hot rolled sales in 1944.

H. R. Rowland

◆

REYNOLDS METALS COMPANY.—*Barlow Brooks,* formerly manager of sales and development of Kinkaid Industries, Chicago, has resigned to become manager of the recently-created Finished Formed Shapes division of the Reynolds Metals Company, with headquarters at Louisville, Ky. The new division will supply a full line of continuous roll formed shapes and finished extrusions to manufacturers. Mr. Brooks was born at Oswego, N. Y., on September 21, 1906, and is a graduate of the State Trade School at Bridgeport, Conn., and of the University of Illinois. After graduation he went with the Standard Coupler Company and within five years became western sales representative, with headquarters at Chicago. In 1935 he joined the Kinkaid organization.

◆

WATSON-STILLMAN COMPANY.—*James S. Wilson* has been appointed manager of plastics equipment sales of the Watson-Stillman Company, Roselle, N. J. Mr. Wilson, who has been associated with Watson-Stillman for several years, was previously head of the plastics molding laboratory. Before that he was with the Plastics division of the General Electric Company.

◆

GALVIN MANUFACTURING CORPORATION.—*E. S. Goebel* has been appointed acting director of field sales in the communications and electronics division of the Galvin Manufacturing Corporation, in direct charge of all field salesmen. Norman Wunderlich has resigned as sales manager. *Daniel E. Noble* has been promoted to general manager of the communications and electronics division at Chicago. In his new position he will supervise the engineering, sales and engineering production departments of the division while retaining his present responsibilities as director of research.

◆

GENERAL STEEL CASTINGS CORPORATION.—*James Macdonald,* since 1939 assistant to the vice-president—sales of the General Steel Castings Corporation, has been appointed assistant to president. Mr. Macdonald was reported incorrectly as having been appointed assistant vice-president in the August issue of the *Railway Mechanical Engineer,* page 364. *Karl S. Howard* has been appointed assistant vice-president. Mr. Howard will continue as general mechanical superintendent. He will also assume the duties of general purchasing agent.

◆

PULLMAN-STANDARD CAR MANUFACTURING COMPANY.—*F. M. Gunn,* manager of the Pullman Car Works of the Pullman-Standard Car Manufacturing Co., has been appointed to assistant to the president, with headquarters as before at Chicago. *Harry B. Reed,* assistant manager of the plant, succeeds Mr. Gunn as manager. *Raymond M. Fox,* acting manager, has been appointed manager of works of the Butler, Pa., plant. Before his transfer to Butler, Mr. Fox was manager of works of Pullman-Standard's Hammond, Ind., plant for six years and as such directed its conversion from a freight-car shop to war work. He has been in the railway car-building business for 39 years. He joined Pullman-Standard in 1929 as an engineer in its Michigan City, Ind., plant; was transferred to the Hammond plant in 1937, and a year later was appointed manager of works there.

Raymond M. Fox

◆

DAMPNEY COMPANY OF AMERICA.—*John W. Laverack,* vice president and treasurer, has been appointed President of The Dampney Company of America, Hyde Park, Mass. Mr. Laverack succeeds *Clarence J. Hunter,* who becomes chairman of the board

and technical director for special concentration on research and development and extension of the work of the Company in its field of technical coatings for power and mechanical operation equipment.

◆

STANDARD STOKER COMPANY.—*Christ T. Hansen* has been appointed western sales manager and *John H. Ichter* eastern sales manager of the Standard Stoker Company, with headquarters at Chicago and New York respectively.

◆

NATIONAL MALLEABLE & STEEL CASTINGS COMPANY.—*Ray E. Valentine* has been appointed St. Louis, Mo., office sales agent for the National Malleable & Steel Castings Company. Mr. Valentine has

Ray E. Valentine

been associated with National Malleable since 1912. After serving in the traffic department, he joined the sales division in Cleveland, Ohio, in 1914. He was assigned to the St. Louis sales office in 1927 and a year later transferred to the Chicago plant, where he remained for sixteen years. He is a graduate of Baldwin-Wallace Law School (1891) and was contracting freight agent of the Wheeling & Lake Erie from 1910 to 1912. Mr. Valentine has been with the War Production Board in Washington since 1943 as chief of the malleable-iron section.

◆

LEHON COMPANY.—*David M. Waterhouse* has been appointed eastern representative of The Lehon Co., Chicago, to handle sales for railroads, car builders, electric lines and others connected with the transportation industry. Mr. Waterhouse will maintain headquarters at 50 Church street, New York.

◆

WESTINGHOUSE ELECTRIC CORPORATION.—*Ralph R. Brady,* for the past three years manager of commercial engineering for the lamp division of the Westinghouse Electric Corporation, has been appointed manager of electric discharge lamp sales.

◆

MONROE AUTO EQUIPMENT COMPANY.—*C. J. Smith,* formerly with the Packard Motor Car Company, has been appointed chief engineer of the Monroe Auto Equipment Company with headquarters at Monroe, Mich. Mr. Smith entered the employ of the Packard organization several years ago and at the beginning of World War II was placed in charge of the experimental engineering program at the tank arsenal proving grounds. In his position with Monroe he will direct the company's widely expanded program which now covers practically every branch of the transportation field and includes products for railroad passenger and freight cars, automobiles, trucks, busses, tractors and various types of war equipment such as tanks, airplanes and heavy transportation equipment.

◆

PEERLESS EQUIPMENT COMPANY.—*Walter H. Radeke,* formerly service manager of the Gould Storage Battery Co., Depew, N. Y., has joined the Peerless Equipment Co., as service engineer, with headquarters at Chicago, servicing Gould storage batteries in railway service.

◆

JOSHUA HENDY IRON WORKS.—*James L. Ray* has been appointed head of the gas and steam turbine engineering department in San Francisco, Calif., of the Joshua Hendy Iron Works, Sunnyvale, Calf. Mr. Ray formerly was chief gas-turbine design engineer of the Allis-Chalmers Manufacturing Company.

◆

AMERICAN LOCOMOTIVE COMPANY.—*John T. Tarpey,* western representative of the Pittsburgh Spring & Steel Co., has been appointed to the sales staff of the Chicago office of the American Locomotive Company. Mr. Tarpey joined the Chicago office of Pittsburgh Spring & Steel in 1916. After military service during the last war, he returned to the company in 1919 and was appointed western representative in 1934.

◆

FRANK B. NUGENT COMPANY.—*Frank B. Nugent,* who has represented the Barco Manufacturing Company, Not Inc., in the northwest territory for the past 22 years, has organized his own company, the Frank B. Nugent Company, with offices in St. Paul, Minn. He will continue to represent Barco, as well as several other manufacturers of railway equipment.

◆

FIRTH-STERLING STEEL COMPANY.—*Lloyd R. Clowes,* Pittsburgh district sales manager of the Firth-Sterling Steel Company, has been appointed assistant general sales manager of the company.

◆

AMERICAN CAR AND FOUNDRY COMPANY.—*E. A. Lofquist,* a graduate of the U. S. Naval Academy and until recently on active duty as a Captain in the U. S. Navy, has been appointed a special representative for the sales department of the American Car and Foundry Company. Mr. Lofquist will have his headquarters at Chicago.

◆

BUCKEYE STEEL CASTINGS COMPANY.—*George T. Johnson* has been elected president and general manager of the Buckeye Steel Castings Company to succeed *A. H. Thomas,* who becomes chairman of the board. Mr. Johnson is a graduate of Cornell University with a degree in mechanical engineering. He joined the Buckeye Steel Castings Company as a moulder's helper in the foundry and progressed through the various departments until he was appointed in charge of the engineering and inspection divisions. Later he was appointed successively third vice-president and second vice-president in charge of production and sales engineering. He was elected first vice-president in charge of the sales department in 1937, with other administrative duties including general supervision of engineering. Mr. Johnson is a member of the American Society of Mechanical Engineers, the American Society of Testing Materials, and has served on various committees touching on the activities of the cast steel and railroad equipment industries.

◆

KENNAMETAL, INC.—*W. D.. Turnbull* has been appointed general sales manager of Kennametal, Inc., Latrobe, Pa.

◆

LEHON COMPANY.—*David M. Waterhouse* has been appointed eastern representative of the Lehon Company, Chicago. Mr. Waterhouse will maintain headquarters at 50 Church street, New York.

◆

WORTHINGTON PUMP AND MACHINERY CORPORATION.—*Harry A. Feldbush,* formerly works manager of the Holyoke, Mass., plant of the Worthington Pump and

H. A. Feldbush

Machinery Corporation, has been appointed vice-president in charge of engineering activities of all works and domestic subsidiary companies of the Worthington Pump & Machinery Corporation. His headquarters will be at the general offices in Harrison, N. J.

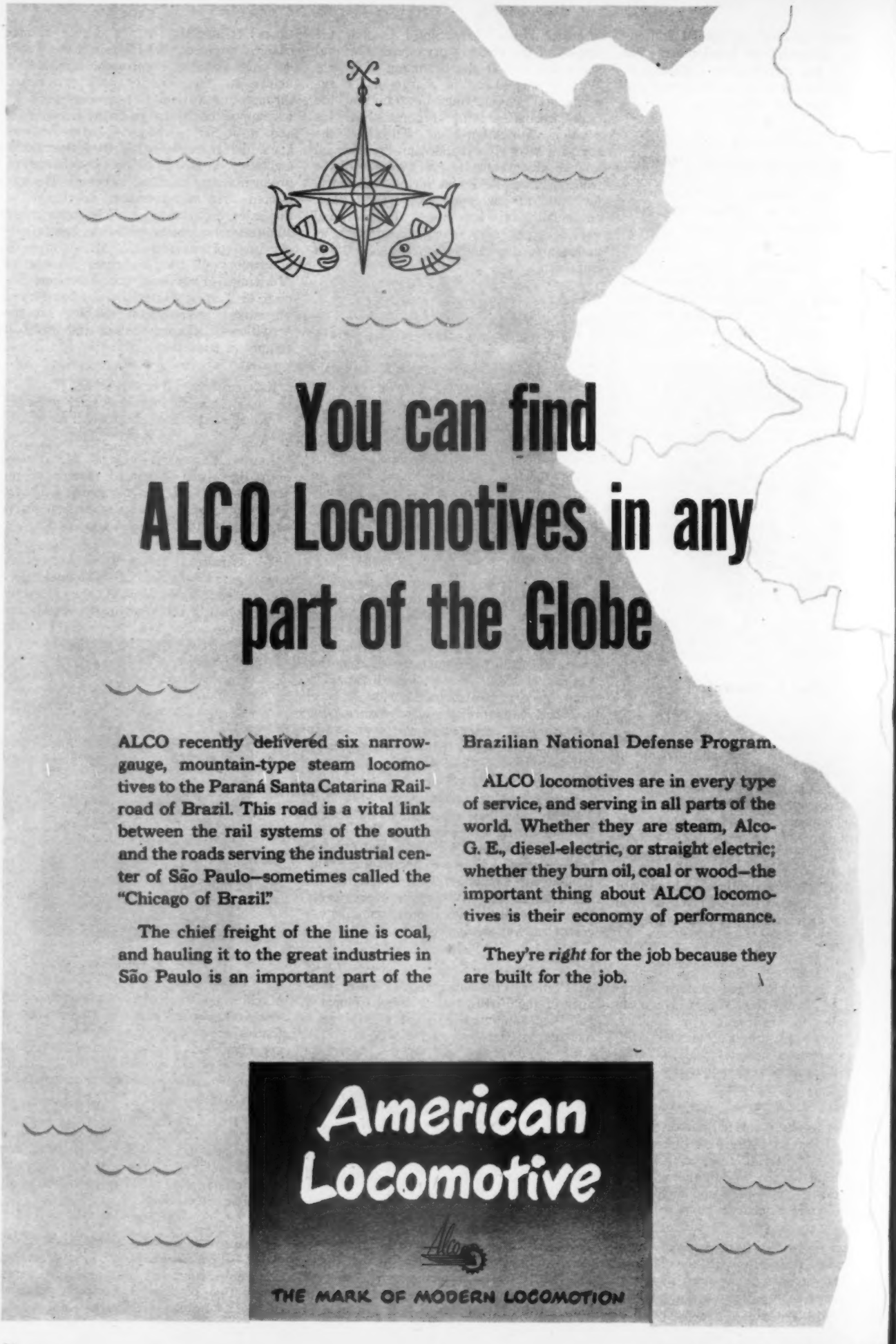
◆

REPUBLIC STEEL CORPORATION.—N. J. *Clarke* and *J. M. Schlemdorf* have been elected senior vice-president and vice-president in charge of sales, respectively, of the Republic Steel Corp.

◆

LOCOMOTIVE FINISHED MATERIAL COMPANY.—The *Frank B. Nugent Company,* St. Paul, Minn., has been appointed a representative of The Locomotive Finished Material Company, Atchison, Kan.

(*Turn to second left-hand page*)



You can find ALCO Locomotives in any part of the Globe

ALCO recently delivered six narrow-gauge, mountain-type steam locomotives to the Paraná Santa Catarina Railroad of Brazil. This road is a vital link between the rail systems of the south and the roads serving the industrial center of São Paulo—sometimes called the "Chicago of Brazil."

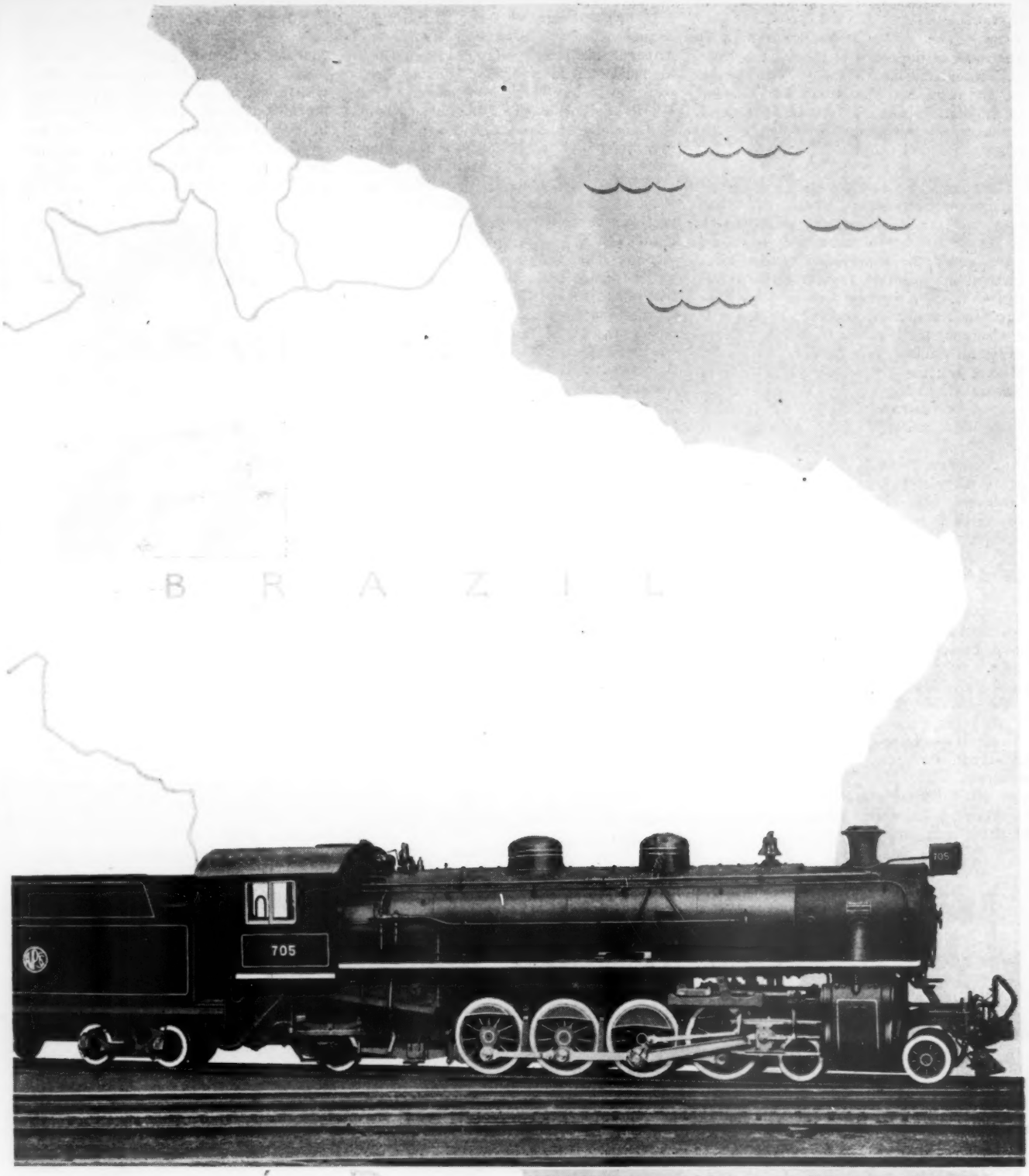
The chief freight of the line is coal, and hauling it to the great industries in São Paulo is an important part of the Brazilian National Defense Program.

ALCO locomotives are in every type of service, and serving in all parts of the world. Whether they are steam, Alco-G. E., diesel-electric, or straight electric; whether they burn oil, coal or wood—the important thing about ALCO locomotives is their economy of performance.

They're *right* for the job because they are built for the job.

American Locomotive

THE MARK OF MODERN LOCOMOTION



Paraná Santa Catarina's Alco-built 4-8-2 type locomotives burn wood. Although the chief freight of the line is coal, the conservation of coal deposits is imperative. And the abundance of wood in the region makes wood the logical and economical fuel for locomotive use.

DAYTON RUBBER MANUFACTURING COMPANY.—*John A. MacMillan* has retired as chairman of the board of the Dayton Rubber Manufacturing Company. During the past 35 years, Mr. MacMillan, a co-founder of Dayton Rubber, has served as general manager, president and chairman of the board. He will continue as a director.

◆

ARO EQUIPMENT CORPORATION.—The Aro Equipment Corporation, Bryan, Ohio, has appointed the following four new jobbers to handle its line of industrial pneumatic tools under the supervision of the local division managers in the respective territories: *C. S. Kegerreis Supply, Inc.*, Elkhart, Ind., under the supervision of Clark & Osborne; the *Western Iron Stores Company*, Milwaukee, Wis., under Charles D. Haven, Jr.; the *General Supply Company*, Kansas City, Mo., under W. L. Etherton; and *Overton and Ross, Inc.*, Wichita Falls, Tex., under W. F. Vogel.

◆

CLEVELAND PNEUMATIC TOOL COMPANY.—The Cleveland Pneumatic Tool Company, Cleveland, Ohio, has announced the formation of a railway division with eastern headquarters at 50 Church street, New York. *John N. Thorp* has been appointed special representative of the division.

◆

HOMESTEAD VALVE MANUFACTURING COMPANY.—*Don H. Krey* has been appointed sales manager, and *Elliott G. Johnson* assistant sales manager of the Homestead Valve Manufacturing Company, Coraopolis, Pa. Mr. Krey will direct all phases of the company's sales efforts including valves, Hypressure Jenny steam cleaners, and Hypressure Jenny compound sales and research; while Mr. Johnson will supervise all valve-sales activities in addition to retaining his duties as director of advertising and public relations.

OKONITE COMPANY.—*E. J. Garrigan*, formerly vice-president and factory sales manager, has been appointed vice-president in charge of sales of the Okonite Company and its Hazard Insulated Wire Works division and its affiliate, the Okonite-Callender Cable Co. Mr. Garrigan who is a director of the company, will continue at the executive offices in Passaic, N. J. He joined the Okonite organization in 1924. *C. E. Brown, Jr.*, formerly vice-president in charge of the company's Washington, D. C., office, has been appointed vice-president and general sales manager to coordinate the activities of the executive offices in Passaic with the company's branch offices. Mr. Brown, who will have offices at Passaic as well as in the New York district sales office, has been with the Okonite sales organization since 1919, first as an agent with the Central Electric Company of Chicago, and later, in 1925, as manager of Okonite's power and light department in the Chicago territory. He will also take over the duties performed by the late W. K. Vanderpoel in acting as a contact executive between the officials of the power and light utilities and Okonite's utility specialists in branch offices.

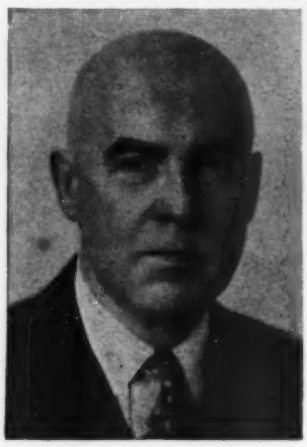
Obituary

L. E. ELLIOTT, service engineer of the National Aluminate Corp., Chicago, with headquarters at Lexington, Ky., died at the home of a daughter in Excelsior, Minn., on July 20.

◆

WILLIAM H. BRYANT, general sales manager of Joseph T. Ryerson & Son, Inc., with headquarters at Chicago, died at his summer home in Iron Mountain, Mich., on July 23.

HAROLD MCCREADY, district manager, New York office, of the Union Switch & Signal Co., died August 1. Mr. McCready was 60 years of age. He was a graduate, with a degree in electrical engineering of the Massachusetts Institute of Technology in 1908. He was employed as a signal helper on the Pennsylvania Lines West, during the summers of 1902 and 1903. He joined the Union Switch & Signal Co. in 1904



Harold McCready

as circuit draftsman and worked on the construction of the New York subway until the summer of 1905. He became signal foreman on the West Jersey & Seashore electrification in 1907. He was appointed assistant engineer of Union Switch & Signal in 1908 and engineer-in-charge, electrical department, in 1912. He was transferred to the sales department in 1914 as New York office manager and became assistant eastern manager in 1923 and district manager of the New York office in January, 1937.

Personal Mention

General

L. C. KIRKHUFF, master mechanic of the New River division of the Virginian at Elmore, W. Va., has been appointed assistant superintendent of motive power, at Princeton, W. Va.

SHERMAN O. RENTSCHLER, whose appointment as superintendent of motive power at the Elgin, Joliet & Eastern, with headquarters at Joliet, Ill., was reported in July issue, was born at Verdon, Neb., on October 12, 1904, and is a graduate of the University of Nebraska. He entered railway service as a special apprentice in the employ of the Missouri Pacific in September, 1923, subsequently serving as a machinist, division foreman, enginehouse foreman and general passenger-shop foreman at various points on the road, including St. Joseph, Mo., Omaha, Neb., and Lincoln; Wichita, Kan., Hoisington and Ossawatomie, and Kansas City, Mo. After serving as general shop foreman at Sedalia, Mo., Mr. Rentschler in August, 1942, became shop superintendent, at Sedalia. On October 1, 1943, he was appointed mechanical superintendent of the Southern district,

Sherman O. Rentschler

with headquarters at St. Louis, and in November, 1944, became assistant chief mechanical officer. He resigned on April 1, 1945, to become superintendent of motive power of the E. J. & E.

D. J. COON, mechanical supervisor of the New York, Chicago & St. Louis, has been appointed fuel supervisor with headquarters as before at Cleveland, Ohio.

W. R. HARRISON, who has been on leave of absence from the Atchison, Topeka & Santa Fe, has returned to the position of mechanical superintendent of the Southern district, with headquarters at Amarillo, Tex.

A. G. KANN, whose promotion to general superintendent of equipment of the Illinois Central at Chicago, was noted in the July issue, was born on August 23, 1894. He entered the service of the I. C. on November 14, 1911, as an apprentice machinist at

(*Continued on next left-hand page*)

MORE YARDS are using "UNION" I.T.C. than all other train communication systems combined

Daily service in 16 great yards, in the hands of regular railroad employes gives the strongest possible proof of the dependability and practicability of "Union" Inductive Train Communication.

No other system of train communication can match this record of performance:

Cleveland, Cincinnati, Chicago & St. Louis Ry.

Sharonville, Ohio. One-way equipment for two locomotives and one office, utilizing one frequency, at the hump classification yard.

Chicago, Burlington & Quincy R.R. Co.

Galesburg, Ill. Eastbound and westbound hump classification yards equipped for one-way communication using two frequencies to separate communications between the two yards. Equipment is installed on 10 locomotives and in the hump conductors' offices at both humps.

Lincoln, Neb. One-way, one-frequency equipment installed on three locomotives and in the hump conductor's office at the hump classification yard.

Great Northern Ry. Co.

Allouez, Wis. One-way equipment, utilizing one frequency installed on two locomotives and in one office at the hump yard.

Louisville & Nashville R.R. Co.

DeCoursey, Ky. Equipment for one-way communication, utilizing one frequency installed on three locomotives and in one office at the hump yard.

Norfolk & Western Ry. Co.

Roanoke, Va. Two-way, one-frequency equipment installed on three locomotives and in one office at the hump yard.

The Pennsylvania R.R.

Altoona, Pa. One-way equipment installed on three locomotives operating in two hump yards. Two offices are also equipped. Two frequencies are employed to separate communications in one yard from those of the other.

Columbus, Ohio. One-way, one-frequency equipment installed on three locomotives and one office at the hump yard.

Harrisburg, Pa. (Enola Yards). One-way equipment installed on nine locomotives operating in two hump yards. Two offices are also equipped. Two frequencies are employed, to prevent interference between the two yards.

Indianapolis, Ind. (Hawthorne Yard). One-way, one-frequency equipment installed on three locomotives and in one office at the hump yard.

Pitcairn, Pa. One-way, one-frequency equipment installed on eight locomotives and in one office at the hump yard.

Pittsburgh, Pa. (Strip District). Two-way equipment, utilizing one frequency installed on two locomotives and three offices in an industrial switching district.

Terminal R.R. Association of St. Louis

East St. Louis, Ill. One-way, one-frequency equipment installed on one locomotive and in one office at the hump yard.

"Union" I.T.C. was developed for railroad use by men who know railroad needs, and has been proved through years of regular railroad service.

UNION SWITCH & SIGNAL COMPANY

SWISSVALE PENNSYLVANIA

NEW YORK CHICAGO ARMY E NAVY ST. LOUIS SAN FRANCISCO

Waterloo, Iowa, subsequently serving as a machinist, assistant night enginehouse foreman, air-brake foreman, and gang foreman. On November 16, 1929, he was promoted

A. G. Kann

to the position of general foreman, with headquarters at Council Bluffs, Iowa; in 1931 was transferred to Waterloo; on September 1, 1938, was appointed master mechanic, with headquarters at Champaign, Ill.; in 1939 transferred to Waterloo, and on July 16, 1940, appointed master mechanic at Waterloo.

P. J. DANNEBERG, who has been acting mechanical superintendent of the Santa Fe at Amarillo, Tex., has returned to his former position of mechanical superintendent of the Northern district, with headquarters at La Junta, Colo.

Master Mechanics and Road Foremen

E. A. MCCRAW, engineer of the Union Pacific at North Platte, Neb., has been promoted to the position of road foreman of engines, with headquarters at North Platte.

T. R. BRITT, traveling fireman of the Union Pacific at North Platte, Neb., has been appointed road foreman of engines, with headquarters at Council Bluffs, Iowa.

E. P. LEE, road foreman of engines of the Union Pacific at Council Bluffs, Iowa, has been appointed road foreman of passenger engines, with headquarters at Council Bluffs.

W. W. LYONS, who has been serving as acting mechanical superintendent of the Northern district of the Santa Fe at La Junta, Colo., has returned to the position of master mechanic at Dodge City, Iowa.

C. G. FOSTER, general foreman of the Virginian at Sewalls Point, Va., has been appointed master mechanic of the Norfolk division, with headquarters at Victoria.

R. G. BENNETT, JR., master mechanic of the Virginian's Norfolk division at Victoria, Va., has been transferred to the position of master mechanic of the New River division, with headquarters at Elmore, W. Va.

D. R. BURGHARDT, fireman of the Union Pacific at Council Bluffs, Iowa, has been promoted to the position of traveling fireman, with headquarters at Council Bluffs, Iowa.

Car Department

C. P. NELSON, assistant superintendent of car shops of the Chicago & North Western at Chicago, has been appointed superintendent of the car department, with headquarters at Chicago.

J. L. TYRE, traveling car inspector of the Atlantic Coast Line, has been appointed general car inspector of the Southern division with headquarters at Waycross, Ga.

G. R. ANDERSEN, assistant superintendent of the car department of the Chicago & North Western at Chicago, has been appointed to superintendent of the car department. Mr. Andersen was born at Kankakee, Ill., on September 27, 1889, and is a graduate of DePaul University. He entered railway service on May 3, 1911, as a car inspector in the employ of the North Western at Milwaukee, Wis., later serving as chief car inspector and assistant car foreman at Milwaukee. On March 1, 1920, he became general car foreman, with headquarters at Butler, Wis., and one year later assistant master car builder at Chicago.

George R. Andersen

In 1925, Mr. Andersen was appointed master car builder at Chicago, and on April 1, 1942, assistant superintendent of the car department.

J. H. WELCH, traveling car inspector of the Atlantic Coast Line, has been appointed general car inspector of the Northern division.

In Military Service

LEGION OF MERIT AWARD

COL. AUBREY M. BRUCE, of Alton, Ill., on leave from the Illinois Terminal Railroad at St. Louis, has been awarded the Legion of Merit for "exceptionally meritorious conduct in the performance of outstanding service" (from February 9, 1943, to May 17, 1945) as superintendent of equipment for the Third Military Railway Service in the Persian Gulf Command, Headquarters now reports. Colonel Bruce received his award from Brig. Gen. Donald P. Booth, commanding the P. G. C., at special ceremonies in Teheran, Iran. "As superintendent of equipment when the Third Military Railway Service assumed operation of the Iranian State Railway," the citation said, in part, "Colonel Bruce demonstrated a high degree of leadership and ability in coordinating and supervising the maintenance and repair of the railway equipment." A veteran of World War I, and a reserve officer when called to active duty in October, 1942, Colonel Bruce was head of the 3rd M. R. S. for two months prior to its dissolution on July 1. In civilian life he was master mechanic of the Illinois Terminal at Alton.

BRONZE STAR MEDAL

Col. Fay L. King, head of the 2nd M. R. S. equipment section. Colonel King, who was district master mechanic for the Chicago, Milwaukee, St. Paul & Pacific before entering the service, won his citation for "services in connection with special installations in L. S. T.'s for ferrying railway equipment from England to France, and for his supervision and planning of repair shops and enginehouses at Cherbourg."

Shop and Enginehouse

P. J. LANE has been appointed general locomotive foreman of the Union Pacific at Omaha, Neb. This is the second such position at Omaha, the first being held by F. J. Stehno, who was appointed in January, 1942. Mr. Lane was formerly foreman of a gang stripping and rebuilding locomotives at Omaha.

BLAIR L. THOMPSON, mechanical inspector of the Canadian National at Montreal, Que., has been appointed night superintendent, Point St. Charles motive power shop at Montreal.

THOMAS BOONE, night superintendent at the Point St. Charles motive-power shop of the Canadian National at Montreal, Que., has retired after nearly 37 years' service.

D. J. EVERETT, who has been serving as acting master mechanic of the Southern at Dodge City, Iowa, has returned to the position of general mechanical inspector at Topeka, Kans.

Obituary

THOMAS M. CONNIFF, superintendent of shops of the Delaware, Lackawanna & Western, at Scranton, Pa., died in a hospital at that city on August 10.

TOMORROW'S POWER TODAY!

It's the
Opposed-Piston Diesel Locomotive
by
FAIRBANKS-MORSE
A name worth remembering

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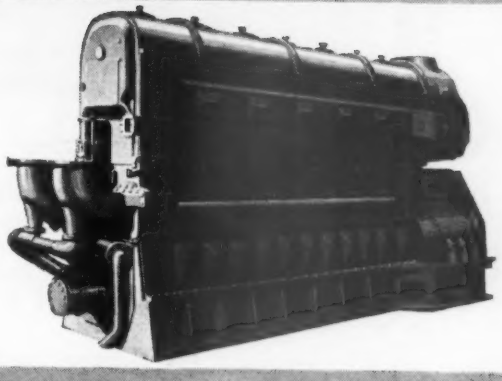
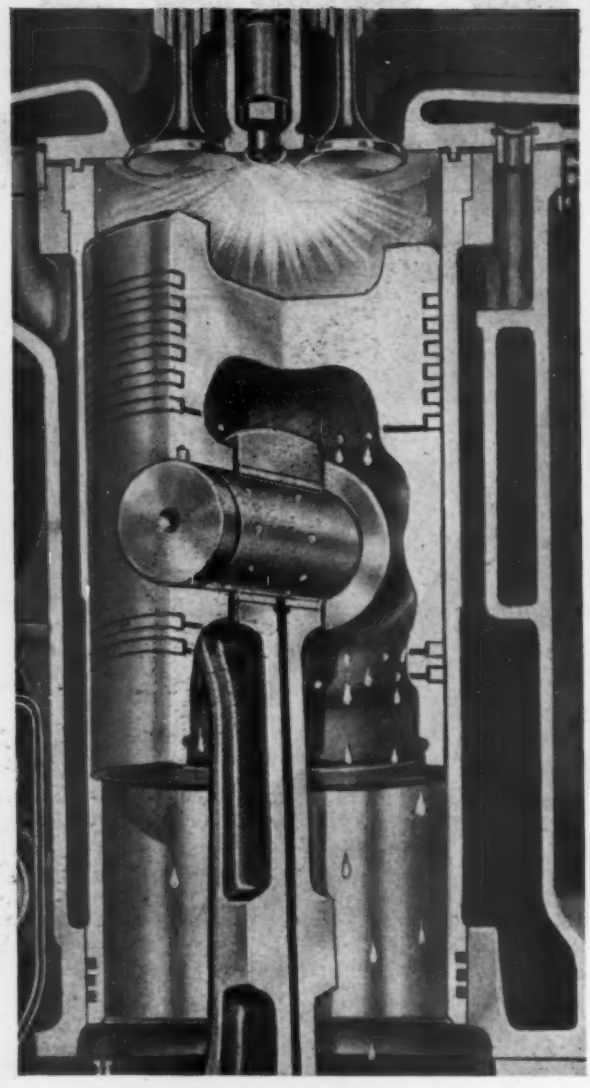


Save Maintenance Manpower and Costs!



NEW ADVANCES IN LUBRICANTS

by SOCONY-VACUUM stretch time between Overhauls of Big Diesels, Track Tools!

THIS cutaway takes you directly to the source of greater Main Line Diesel availability—*inside the cylinder*.

Here oil must keep rings, pistons and valves *free*, to prevent excessive power loss. To keep wear at a minimum, its film must be strong enough to resist rupture, even when squeezed to microscopic thinness.

Gargoyle D.T.E. Oils (Nos. 1 to 5) are specially refined to do these two important jobs. Not only do they reduce carbon formation to an absolute minimum, but any deposits which do form are soft and fluffy—do not cause rings to stick.

These famous oils are also giving this same high performance in large stationary and marine Diesels.

For your automotive-type Diesels, Delvac 900 Series Oil meets the special requirements of these smaller, high-speed engines.

Ask your Socony-Vacuum Representative for the correct grades for your Diesels. You'll save man-hours and repairs...assure engines "ready-to-run" at all times.

SOCONY-VACUUM OIL COMPANY, INC.
Standard Oil of N.Y. Division • White Star Division • Lubrite Division • Chicago Division • White Eagle Division • Wadhams Division • Magnolia Petroleum Co. • General Petroleum Corporation of California.

TRACTORS. Socony-Vacuum *oils* help keep engines *clean* . . . protect valves, rings, bearings against undue wear . . . assure more economical engine operation. Socony-Vacuum *greases* provide excellent lubrication for all chassis fittings . . . seal out grit, dirt, water.

LESS WEAR AND LONGER LIFE FOR MAINTENANCE-OF-WAY EQUIPMENT

The 3 R's of good lubrication are your best cue to more efficient track tool operation. These are—the *right oil or grease,* applied in the *right place* and in the *right way*.

To help you get these, Socony-Vacuum has worked closely with builders, and developed special railroad lubricants which provide highest possible lubricity, reduce wear to a minimum, assure more continuous operation of all tools and their motors.

Ask your Socony-Vacuum Representative to recommend the oils, greases and hydraulic fluids exactly right for your maintenance-of-way equipment...and to assist you in their correct application.

HEAVY EQUIPMENT. Special Socony-Vacuum products cling to heavy exposed gears, cushion shock loads, protect gear teeth. Special transmission lubricants will not channel, keep gears well lubricated at all times. Special oils help assure continuous full power from engines.

AIR TOOLS. On jack hammers, tie tampers and other air-driven maintenance equipment, Socony-Vacuum oils protect moving parts against wear...resist washing action of water. Other quality lubricants are specially refined to provide best protection for air compressors.

GARGOYLE

Railroad Lubricants

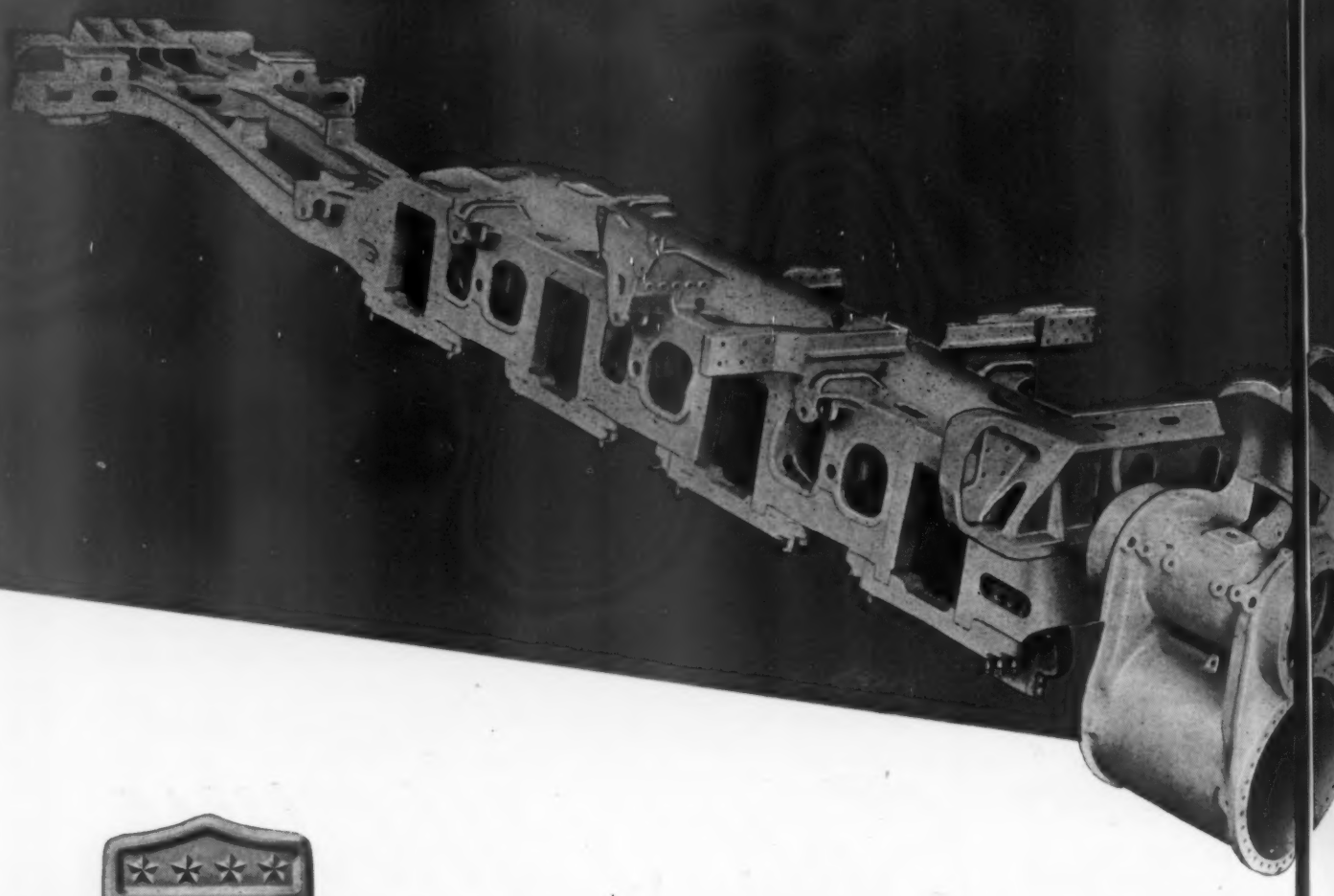
IT PAYS TO KNOW WHAT'S NEW IN LUBRICATION

SOCONY-VACUUM OIL COMPANY, INC.

TUNE IN "INFORMATION PLEASE"—MONDAY EVENINGS, 9:30 E.W.T.—NBC

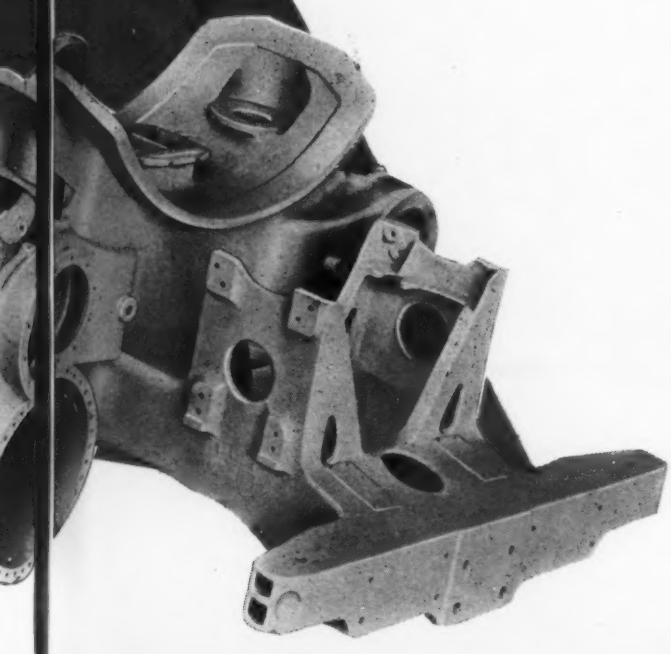
PROVING THEIR MERIT—

Year After Year—



GENERAL STEEL

—COMMONWEALTH LOCOMOTIVE BEDS



Service records of all types of locomotives equipped with COMMONWEALTH CAST STEEL LOCOMOTIVE BEDS are conclusive evidence that Cast Steel Beds keep locomotives in action longer—enable them to move more passengers and freight, with less time out for repairs.

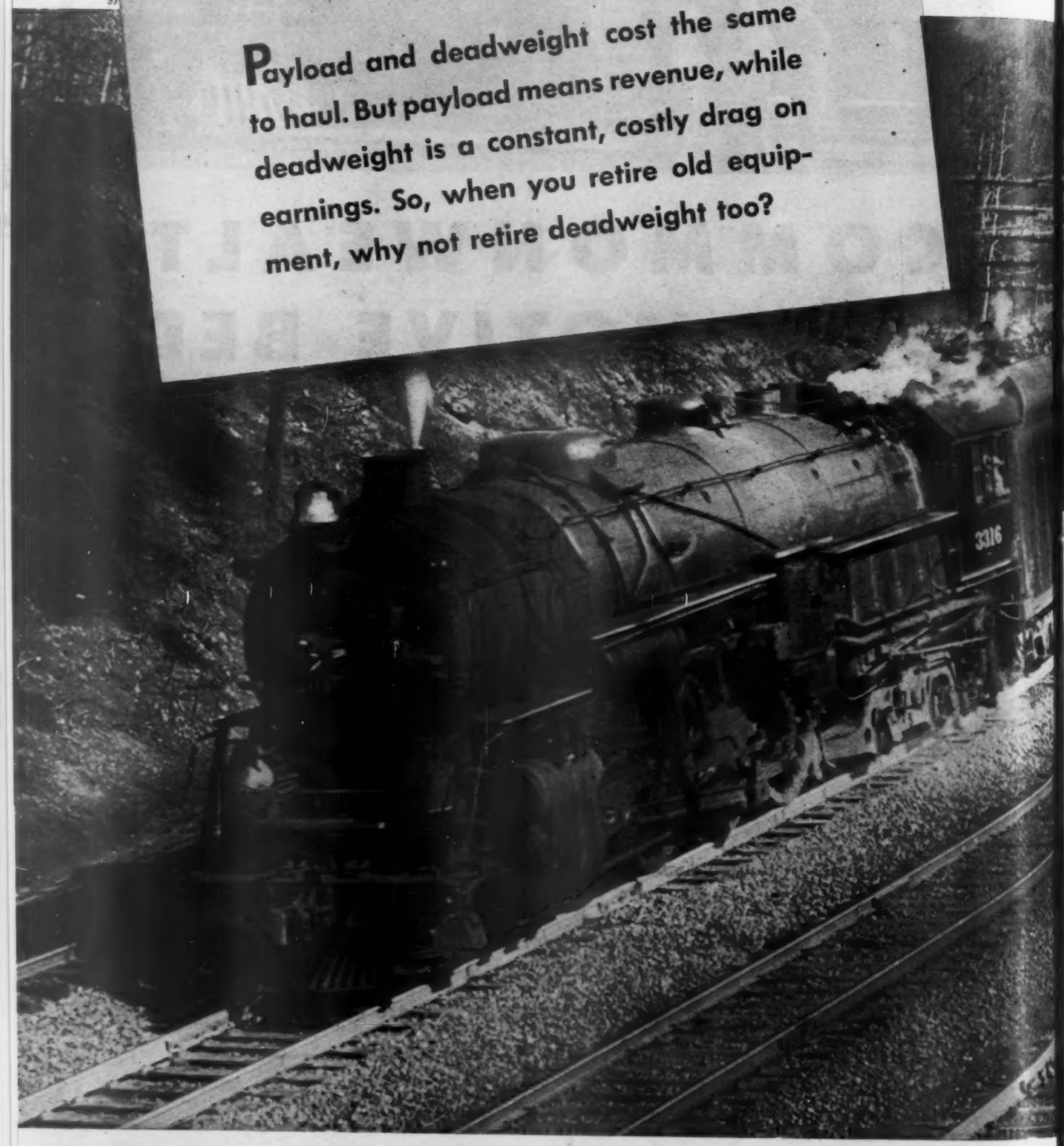
One-Piece Locomotive Beds greatly simplify locomotive design and construction, eliminate many separate parts, assure permanent alignment of frame and cylinders and provide greater strength with less weight.

All-important in these days of intensive service, COMMONWEALTH BEDS reduce shopping time, man-hours of labor, repair and maintenance expense.

CASTINGS EDDYSTONE, PA.
GRANITE CITY, ILL.

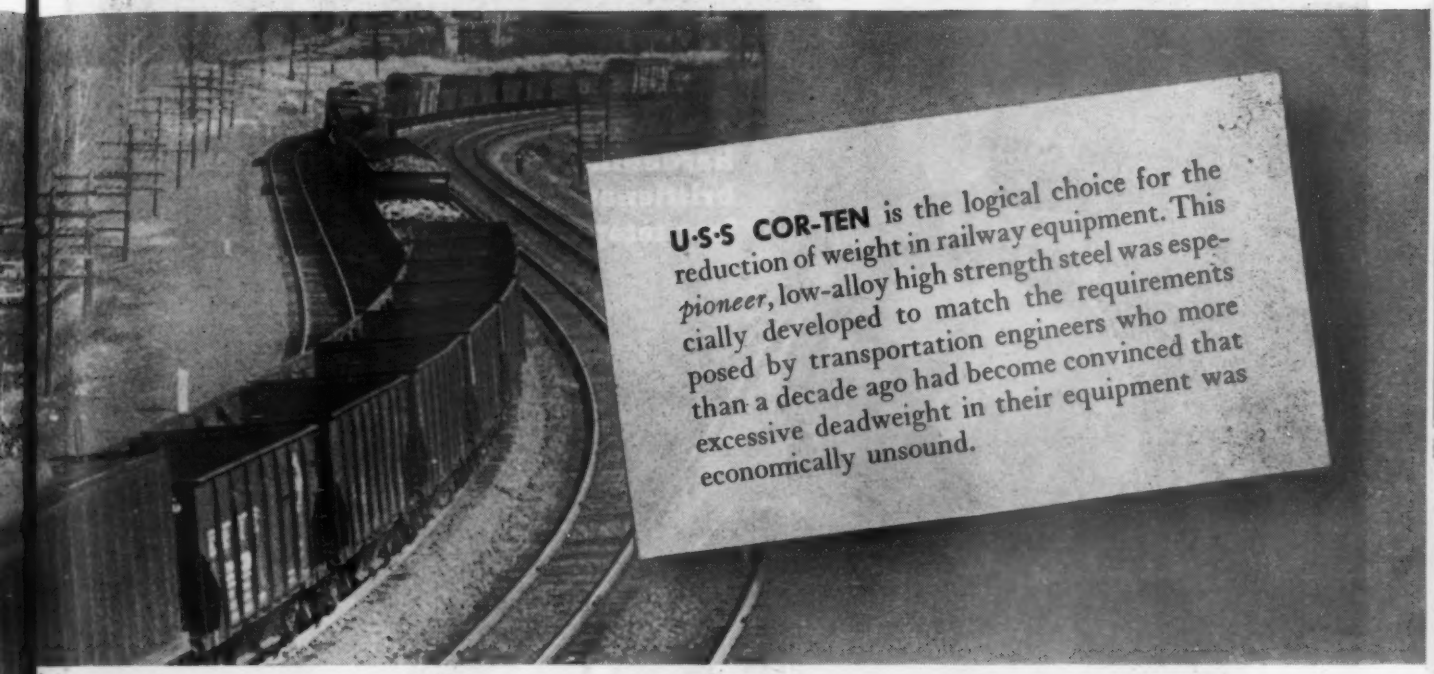
Deadweight pays no dividends

Payload and deadweight cost the same to haul. But payload means revenue, while deadweight is a constant, costly drag on earnings. So, when you retire old equipment, why not retire deadweight too?



UNITED STATES

. . build lighter with U·S·S COR-TEN


U·S·S COR-TEN is the logical choice for the reduction of weight in railway equipment. This pioneer, low-alloy high strength steel was especially developed to match the requirements posed by transportation engineers who more than a decade ago had become convinced that excessive deadweight in their equipment was economically unsound.

WHEN we asked leading railway engineers what they needed to provide lighter, more efficient designs — that would sacrifice nothing in maintenance costs, service life or safety — their answers were virtually identical.

First of all they wanted *greater strength,* that by permitting a decrease in section would reduce weight. *(U·S·S COR-TEN'S minimum yield point of 50,000 p.s.i. is one and one-half times that of plain structural steel.)*

They next demanded increased corrosion resistance to offset reduction in section thickness. *(U·S·S COR-TEN'S resistance to atmospheric corrosion is 4 to 6 times that of plain steel, is 2 to 3 times that of copper steel.)*

Then they wanted a composition that, in the as-rolled condition, would form easily, hot or cold, that could be readily welded without heat treatment and without annealing or stress-relieving. *(U·S·S COR-TEN meets all these requirements. It fabricates readily and can be handled on the same equipment as carbon steel.)*

Finally they wanted a steel of relatively low cost. *(U·S·S COR-TEN'S initial cost per pound is less than 50% higher than plain carbon steel. But, by skillfully lightened design and the proper fabricating methods the cost of the finished structure is, in many instances, little if any more. In some cases it actually costs less in terms of tons capacity.)*

• • •

It is because it so ideally fills the difficult requirements of economic lightweight construction that more than 51,000 freight cars of all types, and some 3,000 passenger units have been built lighter with U·S·S COR-TEN. Our intimate association with the builders of this equipment enables us to place at your disposal an unequalled experience in lightweight construction that your engineers are sure to find helpful.

AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
NATIONAL TUBE COMPANY, *Pittsburgh*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Supply Company, Chicago, *Warehouse Distributors*
United States Steel Export Company, New York

USS HIGH STRENGTH STEEL UNITED STATES STEEL

STEEL

Molybdenum in steel combines full hardening with freedom from temper brittleness to produce optimum low temperature impact strength.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.

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ASSURE LONGER LIFE

BUY MORE WAR BONDS

The Marquette METAL PRODUCTS CO.

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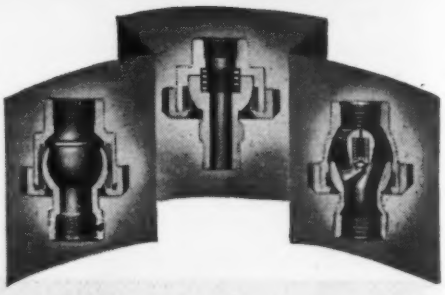
Manufacturers of HYDRAULIC AND ELECTRIC WINDSHIELD WIPERS FOR AIRCRAFT
HYDRAULIC GOVERNORS FOR DIESEL ENGINES • ROLLER BEARING TEXTILE SPINDLES • FUEL OIL PUMPS
AIR COMPRESSORS • PRECISION PARTS AND ASSEMBLIES

Indispensable Fluid Control

THROUGH RESPONSIVE MOVEMENT

Modern industry and modern transportation alike depend on controlled circulation of vital fluids . . . oil, gases, water, steam. For these arterial systems, Barco Flexible Joints have provided necessary protection for over 30 years . . . guarding these mechanical "life-lines" against vibration and shock . . . compensating for contraction and expansion. For complete information, write to Barco Manufacturing Company, Not Inc., 1808 Winnemac Avenue, Chicago 40, Illinois. In Canada: The Holden Co., Ltd., Montreal, Canada.

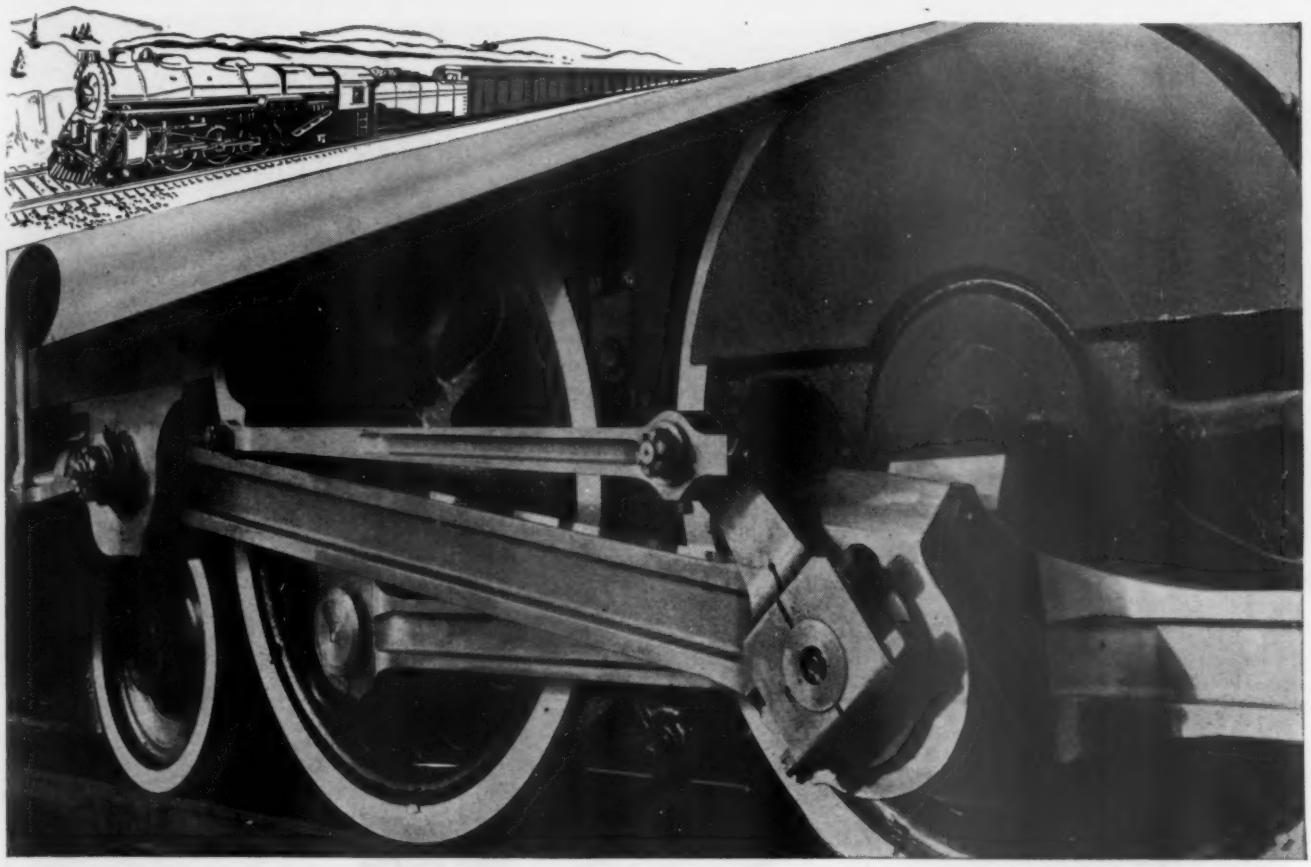


BARCO ***FLEXIBLE JOINTS***

THE FREE ENTERPRISE SYSTEM IS THE SALVATION OF AMERICAN BUSINESS

Not just a swivel joint . . . but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

"MOVE IN EVERY DIRECTION"



For Safety in Highly Stressed Parts

—No Other Material Can Equal ALLOY STEELS

When it becomes impractical or impossible to further enlarge sections of operating parts to increase strength, especially where concentration of stresses occurs, the answer probably will be found in Republic Alloy Steels.

Alloy Steels provide an outstanding combination of qualities found in no other material—including those properties essential to safety in designing light-weight equipment to carry heavier loads at higher speeds.

For in alloy steels you will find highest strength values and the most favorable strength-to-weight ratio. You are assured of greatest toughness. You have at your command the widest range of hardenability and a knowledge that hardened areas will be uniform in their resistance to wear.

Add to these qualities resistance to fatigue—a very important quality in highly stressed working parts—resistance to heat and cold—resistance to corrosion—and you have a material with the ability to insure safety, to extend service life of equipment, and to cut maintenance and replacement costs.

Republic—world's leader in the production of alloy steels—is ready to discuss the advantages of these steels as applied to your individual uses. Write us.

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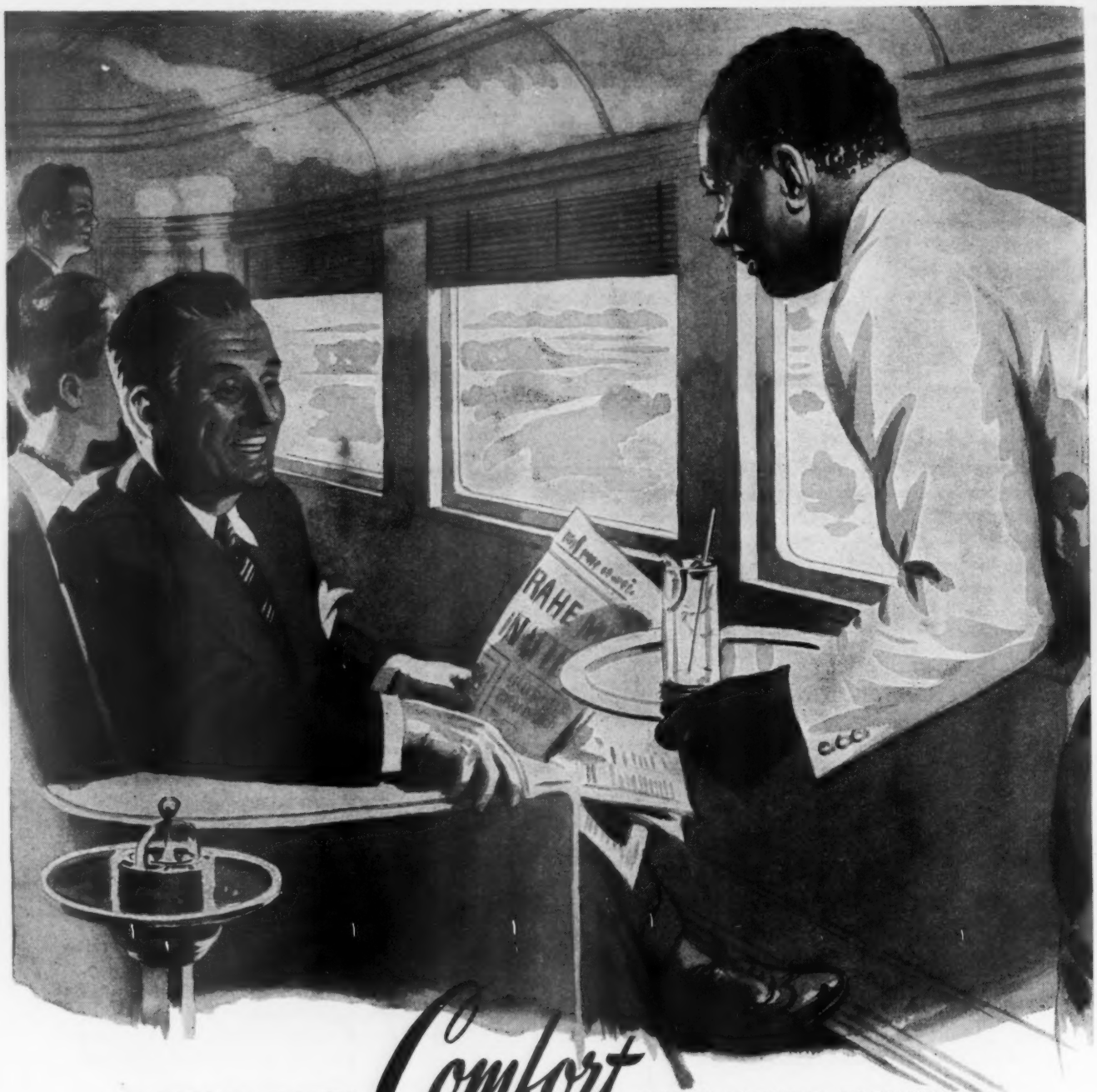
ALLOY STEELS

Also Carbon and Stainless Steels—Sheets—Plates—Pipe—Upson Bolts, Nuts and Rivets—Electrunite Solder Tubes



WAUKESHA-CREATED *Comfort* MAKES PLEASED PASSENGERS!

because . . . Waukesha Ice Engine Air Conditioning cools cars standing in the terminal as well as on the road. It is completely independent of car location or movement, terminal standby service, or the locomotive. Its full cooling capacity is under automatic thermostatic control, and available at all times and in all places. By modulation, the cooling is proportioned to the demand, reducing wide fluctuations in temperature and humidity—a great comfort feature.

because . . . Full Voltage Illumination by the Engine-Generator completes the comfort cycle. Waukesha Engine-Generators are also automatic and completely independent of car movement or location. Full output is available on demand at all times—in the terminal, on the road, winter or summer, day or night.

because . . . Waukesha Ice Engine and Engine-Generator—the Comfort Twins—are backed by 10 years' use on 25 of America's major railways and many Pullmans. Include the Waukesha Comfort Twins in your new equipment plans. Write for Bulletins 1114 and 1179.

Refrigeration Division

WAUKESHA MOTOR COMPANY

WAUKESHA • WISCONSIN

Largest Builders of Mobile Engine-Driven Refrigeration and Generator Equipment

STANDARD ENGINEERS NOTEBOOK

CALOL RPM

All-year pressure gun grease withstands any climatic condition

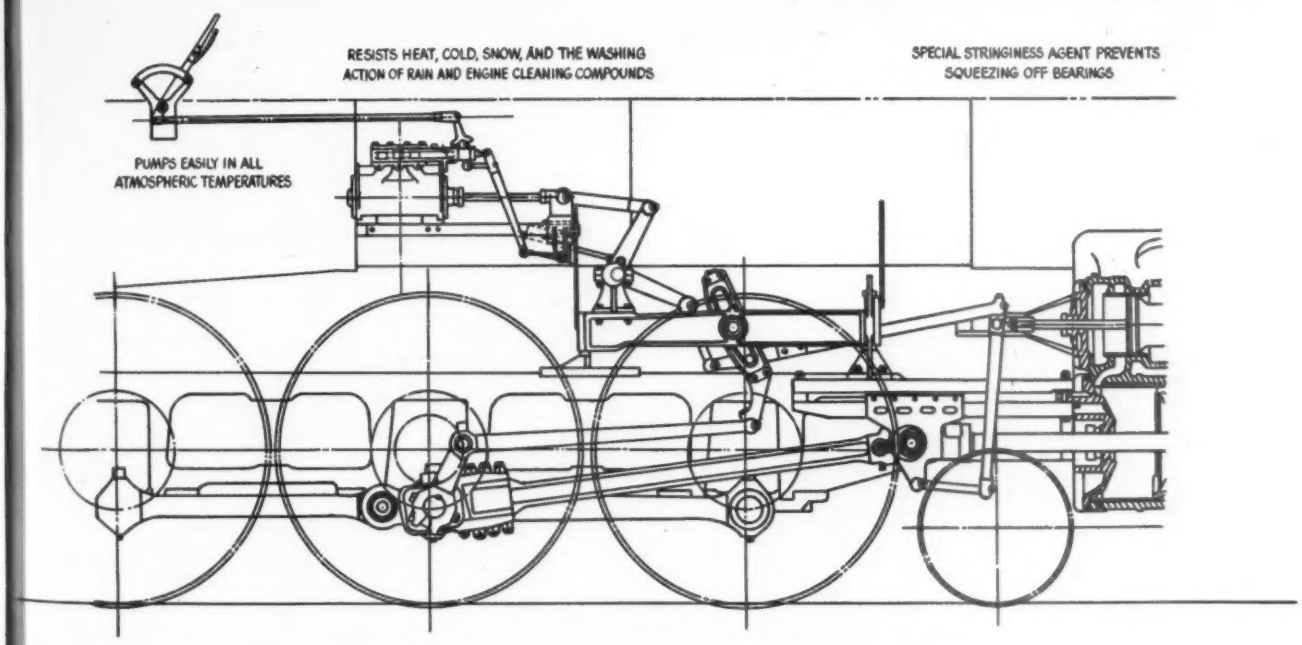
Developed for the lubrication of locomotive valve-motion bearings, shoes, wedges, hub liners and other soft-grease-lubricated parts on locomotives, Calol Pressure Gun Grease will stand up in any season of the year and in any weather encountered along railroads in the United States.

The water-resistant nature of Calol Pressure Gun Grease prevents washing away or any change in its characteristics when in contact with rain, ice and snow on a run, or when coming in contact with cleaning solutions.

Calol Pressure Gun Grease is especially made to withstand continuous shocks on bearings without squeezing or rubbing off. A special stringiness agent and heavy-bodied oil added to its water-resistant-type soap body provides this quality and maintains a tough lubricant film.

It feeds slowly from reservoirs to bearings, assuring thorough lubrication throughout maximum service periods.

There is a special grade of Calol Pressure Gun Grease, "Summer", for unusually severe service.


RESISTS HEAT, COLD, SNOW, AND THE WASHING ACTION OF RAIN AND ENGINE CLEANING COMPOUNDS
SPECIAL STRINGINESS AGENT PREVENTS SQUEEZING OFF BEARINGS
PUMPS EASILY IN ALL ATMOSPHERIC TEMPERATURES

There is a Calol Product to meet every industrial lubrication problem. For information, write Standard of California, 225 Bush Street, San Francisco 20, California.

FOR EVERY JOB A **STANDARD OF CALIFORNIA** TEST-PROVED PRODUCT

NATION-WIDE *Dependable* STEAM OPERATION

HOLLOW *flexible* STAYBOLTS

★

FLANNERY BOLT COMPANY

BRIDGEVILLE ★ PENNSYLVANIA

IT WAS A LONG WAY FROM BERLIN TO TOKYO
BUT... AMERICAN RAILROADS MADE IT SHORTER.....

The railroads have been performing miracles since 1939 by working men and equipment to near breaking point. U. S. railroads last year, regardless of weather conditions, hauled 740 billion ton-miles of freight, more than double the 1939 total. Passenger miles trebled in the 5 years to 96 billions. The last few months the railroads faced the task of moving as many troops across the U. S. continent as they had done in the past three years. Traffic to Los Angeles was near capacity, while 13,000 Government freight cars rolled into San Francisco daily. (1,000 a year ago). Now, the returning veterans will need more space on trains to carry them home to every point in the U. S.

Every American citizen is today conscious of the job the railroads have been doing, and, that faced with serious man-power and equipment shortages, it has been difficult to provide the usual high degree of efficient maintenance on rolling stock.

"TENSION THERE IN SPITE OF WEAR"

RELIANCE LOCOMOTIVE HY-CROME SPRING WASHERS

have been doing their bit by keeping motive power assembled parts TIGHTER LONGER . . . thus helping to save critical man-power and material by automatically compensating for inevitable wear and maintaining that all important bolt tension in assembled parts. When post-war rail requirements are released, remember RELIANCE LOCOMOTIVE HY-CROME SPRING WASHERS are an important *quality* railway accessory.

Write for illustrated Motive Power folder today.

EATON

EATON MANUFACTURING COMPANY

OFFICES AND PLANTS **MASSILLON, OHIO**

Reliance Division

Sales Offices: **New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal**

FEED WATER HEATING
By Coffin

How Heat Transfer Loss Affects Net Feed Water Heater Savings

HEAT Transfer Loss is the difference between the temperature of the saturated exhaust steam in the feed water and the temperature of the feed water entering the boiler.

It is a direct loss of possible feed water heater savings and amounts to 1% of the gross fuel cost per locomotive per year for each 11° difference in temperature.

ON THE COFFIN FEED WATER HEATER TESTS LISTED BELOW, THE AVERAGE COST OF HEAT TRANSFER LOSS IS LESS THAN 53/100 of 1% OF THE TOTAL GROSS FUEL CONSUMED.

Average Temp. Water in Tender	Average Temp. Saturated Exh. Steam in Steam Space of Heater	Average Temp. Water Entering Boiler	Ave. Diff. Temp. Water and Temp. Ex. Steam—Degrees	Average Degree of Water Temp. Rise	Ave. Gross Fuel Saved % based on 1% for each 11° Rise
50	220.6	217.2	3.4	167.2	15.2
65.5	228.8	220.0	8.8	154.5	14.0
44	226	221	5.0	177.0	16.1

THE J. S. COFFIN, JR., COMPANY
Englewood, New Jersey

PLEASE SEND FEED WATER HEATER BULLETIN

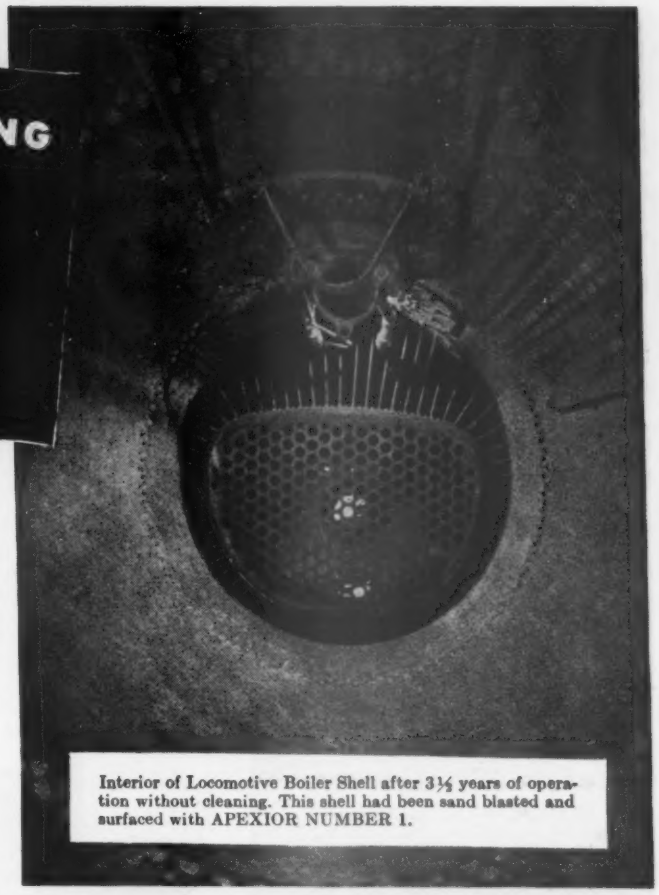
NAME _____

COMPANY _____

ADDRESS _____

HOW APEXIOR SURFACING CUTS LOCOMOTIVE SHOP TIME

Easier Cleaning . . . More Effective Washing . . . Longer Service from Boiler Metal



Interior of Locomotive Boiler Shell after 3½ years of operation without cleaning. This shell had been sand blasted and surfaced with APEXIOR NUMBER 1.

A protective coating of APEXIOR NUMBER 1, a few thousandths of an inch thick, over the water side of locomotive boiler shells and other surfaces exposed to boiler water and steam makes a big saving at shopping time.

APEXIOR retards formation of scale and prevents any chemical bonding with the metal. What scale does adhere comes away easily. Furthermore, an APEXIORIZED surface remains smooth; boiler deposits have little to cling to, and flush away easily.

By preventing water-or-steam contact with metal, APEXIOR NUMBER 1 effectively retards or checks corrosion and pitting in locomotive boilers. Coating water contact areas subject to embrittlement or accelerated stress corrosion has proved effective in minimizing these hazards. The APEXIOR NUMBER 1 coating needs no attention between shoppings.

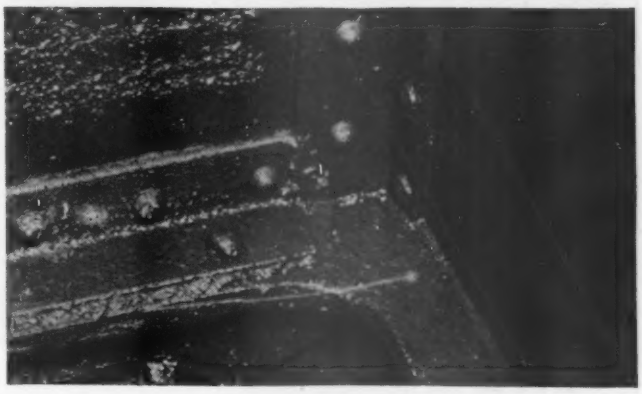
APEXIOR NUMBER 1 is applied in thousands of locomotive boilers subject to Interstate Commerce Commission inspection.

Supplements Feedwater Treatment

APEXIOR NUMBER 1 is brush-applied and therefore is not a substitute for feedwater preparation or chemical treatment. It is inert to all the chemicals generally used and supplies protection for metal in service under boiler water and steam temperatures and pressures, supplementing the work of the chemist and water service engineer by increasing the durability and raising the service quality of the boiler metal.

APEXIOR NUMBER 3

This brush-applied, durable coating protects the water space of locomotive tenders. It air-dries to a chemically inert, shiny-black film, resistant to water or moisture and chemicals used in water conditioning. It does not affect potability of water. Picture shows interior of tender cistern 21 months after surface at right was coated with APEXIOR NUMBER 3. Corroded surface at left was not coated, for comparative test.



See *Locomotive Cyclopoedia*. And write for Bulletin.

APEXIOR — *Keeps new metal new . . . Gives old metal new life* — DAMPNEY

THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Boston 36, Mass.

Please send free Bulletin.

Name.....

Company.....

Address.....

.....

SPECIALLY BUILT *Electric Motors*

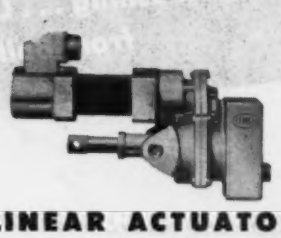
From 1/32 hp to 100 hp

Electric motors—motor drives—linear and rotary actuators—control motors—synchronous motors—self-contained clutch and gear reduction motors—speed increasers—right angle drives—pump motors—submersible motors—splash proof and explosion proof motors—dynamotors—generators—instrument drive motors—splash proof inverters—blower motors—fan cooled motors—self synchronous motors.

Submit your problem jobs to EEMCO engineers. Let the design experience of EEMCO give you motors tailored to the work for maximum efficiency, for maximum economy, for minimum trouble.

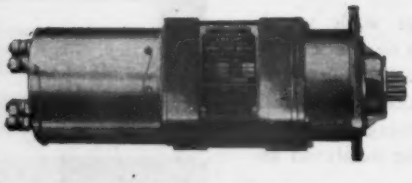
ROTARY ACTUATOR

Self-contained unit—⅛ hp motor with magnetic clutch and brake—Compound planetary and worm and sector gearing gives a reduction of approx. 15,000 to 1. Maximum drive shaft torque is 6000-inch-pounds. Can be wound for a 28 or 32 volt system—Output: 5/10 rpm.



LINEAR ACTUATOR

Self-contained unit, 1¼ hp, 10,000 rpm motor—With magnetic clutch and brake—A double integral gear reduction unit operates screw jack actuator providing 2½" travel on the jack in less than 2 seconds, with 3000 pounds max. load—Control gear reduction drive opens and closes limit travel switches.

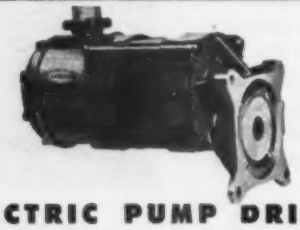


MOTOR DRIVE

Intermittent duty type, 2 hp, 7500 rpm motor, with magnetic clutch and brake—Thermally protected: also protected against exposure to dust, sand or salt spray—Designed for low impact torque.

MOTOR DRIVE

Thermally protected 1/6 hp motor—With magnetic clutch and brake—Complete unit weighs 4¾ pounds—Shaft output is 8-inch-pounds at 1200 rpm—Straight 8 to 1 gear reduction for work actuation of various kinds—Double reduction and worm drive turns cams for limit motion control.



ELECTRIC PUMP DRIVE

A 3 hp intermittent duty, 2 hp continuous duty, 9000 rpm motor—Designed for power driving complex equipment—Standard AN take-off flange, female spline take-off shaft—Weight, 12.4 lbs.

SPLASH PROOF INVERTER

Designed to convert 32 volt d-c current into 110 volt 60-cycle a-c current—Totally enclosed, fan-cooled model with 500 volt amperes capacity continuous duty; 900 volt amperes peak capacity intermittent duty—Can be adapted for use with a power supply source of 110 volt d-c.

RIGHT ANGLE BLOWER DRIVE

Continuous duty type, ⅛ hp, fan-cooled, 7000 rpm motor with right angle gear box and drive shaft—Gear ratio of 1 to 1—70% efficiency—For use in a 28 volt system—Lifetime motor lubrication.

SEALED VAPOR PROOF MOTOR

Double enclosed 2½ hp d-c continuous duty motor—integral gear reduction of 3.8 to 1—Approx. output rpm 2400—Overload capacity 150% for 15 minutes—32 or 110 volt d-c—Internal fan cooling system.

EEMCO

ELECTRICAL ENGINEERING AND MFG. CORP.

4606 West Jefferson Boulevard, Los Angeles 16, California

NO WEAK SPOTS

IN REPUBLIC ELECTRUNITE BOILER TUBES

When ordering new boilers . . . when retubing existing equipment . . . specify Republic ELECTRUNITE Boiler Tubes. Then put them in operation with confidence—because there are no weak spots in these modern tubes. They are equally strong at every point in their structure.

Why? Here are the reasons—

First: Republic ELECTRUNITE Boiler Tubes are made from highest quality flat-rolled steel. When formed into tubular shape, wall thickness is *absolutely* UNIFORM—throughout every length.

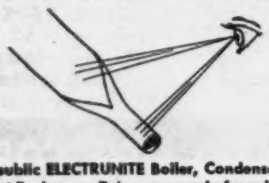
Second: With Republic's *improved* method of electrically welding the tubing, the weld area is 100% as strong as any other point in the wall. Thousands of tests, together with hundreds of installation service records of more than 150,000,000 feet of ELECTRUNITE Pressure Tubing in all types of steam generating and heat transfer equipment, conclusively prove that statement.

And Third: Because Republic ELECTRUNITE Boiler Tubes are scale-free, there is less danger of localized corrosion causing premature tube failure and costly service interruptions.

Before you again order new boilers or retube present equipment, it will be to your advantage, safety and profit to thoroughly investigate Republic ELECTRUNITE Boiler Tubes.

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

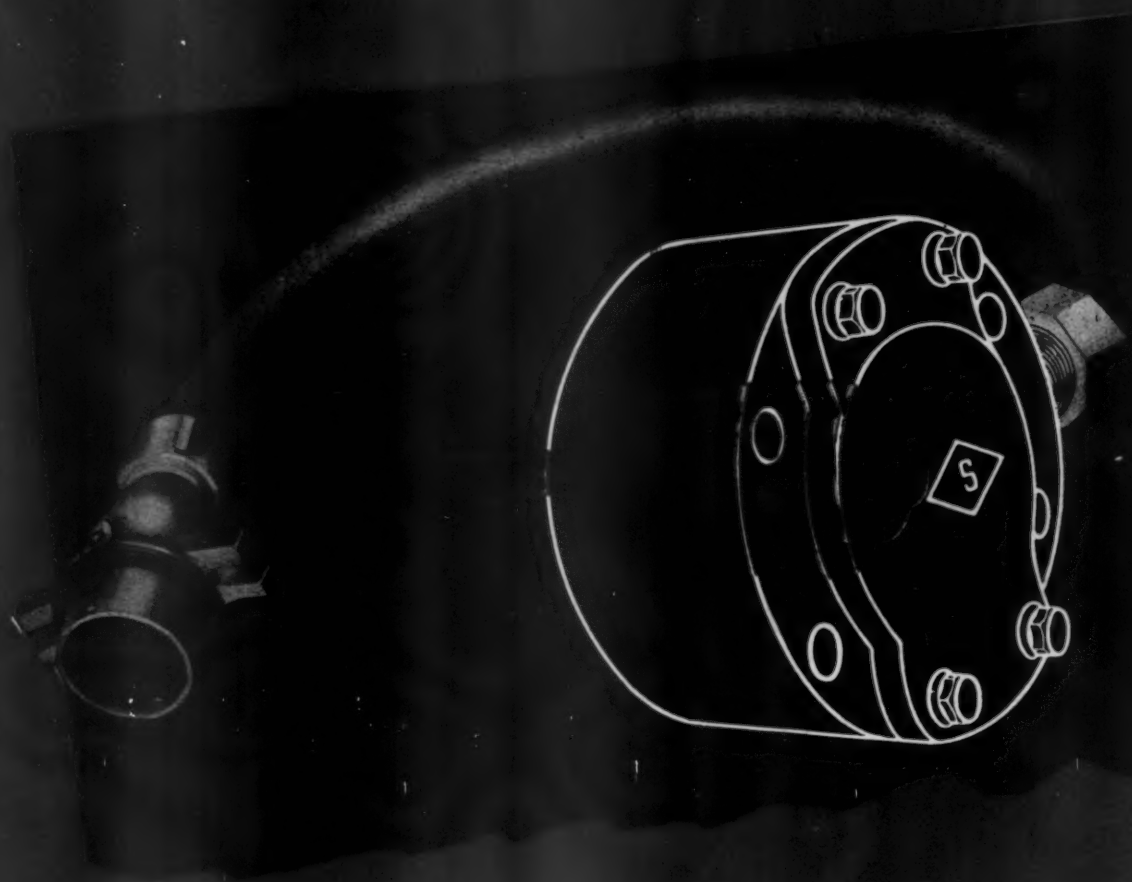
INSPECTED INSIDE AND OUT



Republic ELECTRUNITE Boiler, Condenser and Heat Exchanger Tubes are made from highest quality flat-rolled steel, *both sides of which are* open to close *visual inspection.* Thus, the surface which becomes the inside wall when formed into tubing is free from hidden defects.

Republic
ELECTRUNITE
BOILER, CONDENSER AND HEAT EXCHANGER TUBES

the American Brake Shoe



SIMPLICITY ITSELF
in construction and operation

• The simplicity of the American Brake Shoe Controller, is shown by the above drawing. There is but one moving part—a rugged rotor.

• Testing is simple, too. Operation can be accurately checked when car is standing or moving.

AMERICAN
Brake Shoe
COMPANY

BRAKE SHOE AND CASTINGS DIVISION
230 Park Ave., New York 17, N. Y.

Controller...

RELIABILITY ITSELF
in prevention of slid flats

• The American Brake Shoe Controller is positive in its detection of wheel slippage . . . instant in its correction . . . unfailing in its restoring of full brake as soon as slippage is eliminated.

• Passenger Traffic and Operating officials welcome the availability of equipment made possible by the use of the American Brake Shoe Controller, proved by years of successful performance on high speed passenger trains.

4139

BARBER-COLMAN

HIGH
TORQUE-WEIGHT
RATIO

•

SELF-CONTAINED
REMOTE BULB
ACTUATING ELEMENT

•

PROPORTIONING CONTROL

•

STABLE OPERATION

•

WIDE RANGE OF
APPLICATIONS

•

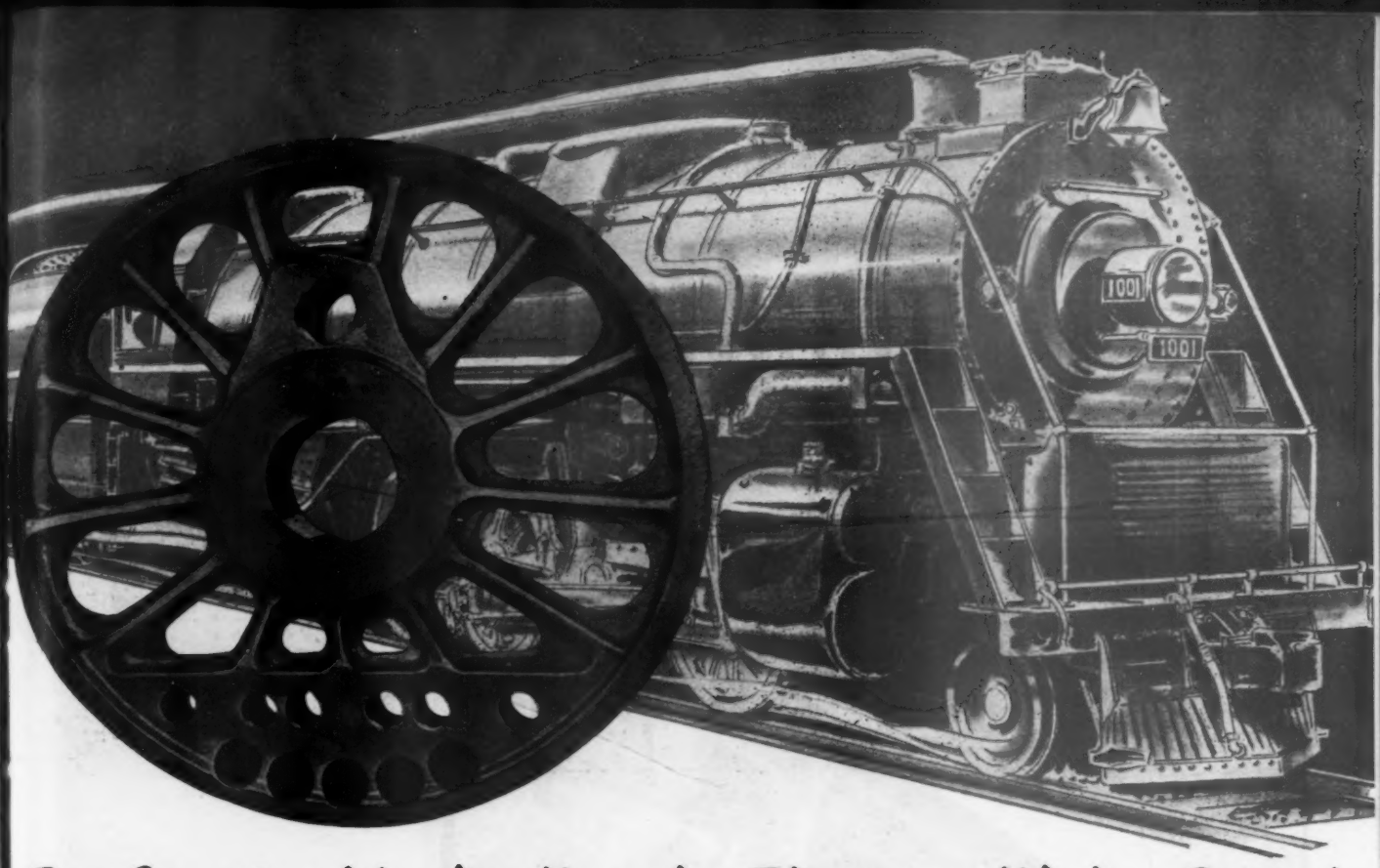
ACCURATE, DEPENDABLE

SELF-CONTAINED POWER UNIT

FOR AUTOMATIC WATER OR OIL TEMPERATURE CONTROL BY ADJUSTING SHUTTERS ON RADIATOR

On diesel engines, greater operating efficiency, lower operating costs, less engine wear, and lower maintenance costs can be achieved to a noticeable degree by using Barber-Colman Self-Contained POWER UNITS. For instance, on control of cooling water temperature, the bulb is set in the water jacket or any convenient place in the line or the radiator. The Power Unit is linked to the radiator shutters. If the water gets too hot, the shutters are automatically opened, *in one stepless true-proportioning motion without overrun or "hunting",* to the correct position to provide the necessary cooling. Likewise, when the water gets too cool, the shutters are closed. The result is maintenance of uniform desired water temperature, with all the resulting benefits. The same principle of arrangement can be applied on oil coolers, and for numerous other purposes on railroad engines of all types. Barber-Colman Control equipment has proved its ability to do an accurate, dependable job in many applications for modern transportation equipment. Learn more about it. *Write for descriptive bulletins today.*

BARBER-COLMAN
COMPANY
ROCKFORD • ILLINOIS

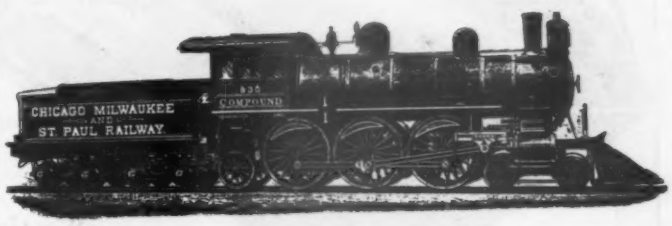


For Greater Loads.. Heavier Thrusts .. Higher Speeds

During the past ten years American locomotives have undergone an evolution resulting in improvements of design and performance which eclipse any other decade in the history of rail transportation. More critical requirements imposed upon the "running gear" of modern, high-speed locomotives have prompted many builders and roads to specify the

UNION WEB SPOKE DRIVING WHEEL CENTER

- ★ Cruciform section spokes for great additional strength.
- ★ Reinforced rim support to eliminate flat spots, out of roundness, etc.
- ★ Correct distribution of metal for better balancing of small diameter wheels.
- ★ Wheels easily inspected before and after installation.
- ★ Troubles due to shrinkage eliminated by simplicity of design.
- ★ Can be made to any material specification.



FIRST OF THE "PACIFICS"...1893

Contrary to general belief, the 4-6-2 or Pacific type made its appearance before the 20th century. No. 830 is one of three compound engines built in 1893 by the Rhode Island Locomotive Works (ALCO) for the Chicago, Milwaukee & St. Paul Railroad. They were designed for fast passenger service and proved eminently successful... Cylinders 21 and 31-inch bore by 20-inch stroke (compound)... Drivers 78 inches in diameter... Total weight 143,000 pounds... Weight on drivers 88,500 pounds.

UNION STEEL CASTINGS

DIVISION OF
BLAW-KNOX CO.
PITTSBURGH, PA.

Protection

Westinghouse
NY-11-F Friction Draft Gear
Certified A. A. R.

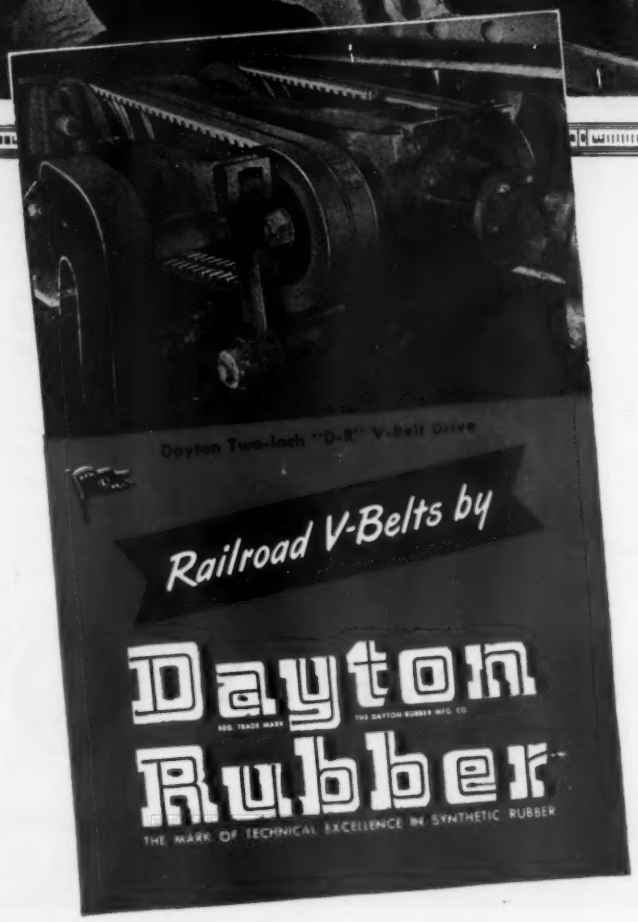
Westinghouse Friction Draft Gears absorb buffing and pulling shocks *at the Couplings;* prevent accumulation of shock pressure on the underframe and entire car structure.

Over 98% of the cars in freight carrying service are A. A. R. construction and over 96% have Friction Draft Gears.

1048

Cardwell Westinghouse Co., Chicago
Canadian Cardwell Co., Ltd., Montreal

Mile-a-minute Touchdowns!



When moving picture shows become standard equipment on America's railroads, quiet, dependable operation of lighting, air conditioning, and other equipment will be an absolute *must.*

The far-sighted equipment designers and managements of America's railroads have long known the importance of quiet, dependable operation of undercar drives. They know, too, that tomorrow's travelers will insist on even more exacting standards of quietness and comfort. That's why equipment designers invariably specify dependable Dayton V-Belts.

A Dayton V-Belt railroad specialist, backed by 40 years of experience in working with railroad designers, will be glad to put that experience at your disposal. Call or write.

THE DAYTON RUBBER MANUFACTURING COMPANY
DAYTON 1, OHIO
The World's Largest Manufacturer of V-Belts

RE-TUBE WITH NATIONAL SEAMLESS

ADVANTAGES OF NATIONAL SEAMLESS BOILER TUBES

SEAMLESS—no uncertainty about full wall strength in every tube.
HIGHER CREEP STRENGTH—only "killed" open hearth and electric furnace steel used.
UNIFORM DENSITY AND SOUNDNESS—improved heat transfer characteristics.
EXCEPTIONAL DUCTILITY—every tube completely annealed—readily manipulated—lowest installation costs.
THOROUGH UNIFORMITY—assured by careful metallurgical supervision.
Over 50 years' proved performance under exacting service. Comply with all recognized specifications—water-tube or fire-tube boilers.

...and, Keep 'Em Rolling

NORTH, South, East and West, seamless boiler tubes are meeting the test of railroading's most strenuous era.

With runs longer, loads heavier, those locomotives whose boilers are fitted with NATIONAL Seamless Tubes are proving their worth by their trouble-free performance. They have what it takes to pay out in more time on the rails—less time in the shop.

For example, the Santa Fe, operating eleven locomotives on the long Kansas City-Los Angeles run without change, ran up an average of more than half a million miles per set of NATIONAL Seamless Boiler Tubes.

B & O's huge "Goliaths" on the heavy, fast freight hauls over the Allegheny Mountains are fitted with NATIONAL Seamless. And, the "Pennsy" chose NATIONAL Seamless for its new S-2, powerful steam-turbine locomotive.

The list of satisfied users grows with the realization that it's cheaper to install boiler tubes that can stand up under today's gruelling wartime service than to shop needed locomotives for frequent repairs and replacements.

Pierced from solid billets of steel, NATIONAL Seamless, the famous "Walls Without Welds," Boiler Tubes, afford positive assurance of full wall strength. There are no longitudinal welds or joints of any kind. They will not crack when being installed or when being "rattled." They remain safely and efficiently tight throughout subsequent service. Where cinder cutting is a problem, NATIONAL heavy-ended tubes have proved the answer.

Bulletin is available on request.

WALLS WITHOUT WELDS

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Tubing Specialties Division

NATIONAL TUBE COMPANY USS STEEL UNITED STATES STEEL

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Export Company, New York

UNITED STATES STEEL

Where Keeping Lighting Levels Up and Upkeep Down is Really a Problem, Specify

BENJAMIN STEELITES

3 Types of STEELITES insure most suitable kind of light distribution

Narrow Beam Units for lighting relatively small areas to a high intensity; or where units must be mounted a considerable distance away from working surface.

Concentrating Units for lighting high narrow bays.

Spread Units for general illumination requirements.

THERE'S a special answer to the problem of sustaining lighting levels and minimizing lighting interruptions in locations where lighting units are subject to severe mechanical strains, smoke, vapor or dust. That answer is the BENJAMIN ARMOR CLAD LIGHTING UNIT, a specially designed unit for the lighting of railroad enginehouses, erecting shops, repair shops and other locations with similar service requirements. This unit is being employed in thousands of locations, for general illumination where illumination levels are required ranging from TWENTY to ONE HUNDRED FOOT CANDLES and more!

STEELITE is made to stand up under the most severe service conditions. Where such conditions prevail, its use cuts maintenance costs. Further, you are assured of getting all the light you pay for and your employees need to do and feel their best. Check its features as highlighted here and given in complete detail in the FREE DATA BULLETIN SENT ON REQUEST. Write Benjamin Mfg. Co., Dept. WW, Des Plaines, Illinois.

BENJAMIN
TRADE MARK

"STEELITE" *Armor-Clad Lighting Equipment*

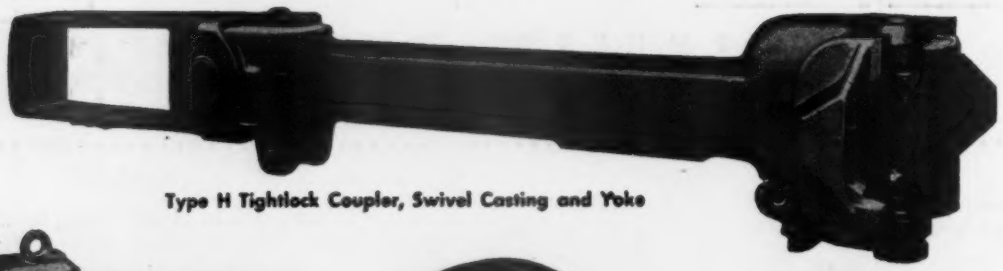
Listed as Vapor-Tight by Underwriters' Laboratories
Distributed Exclusively Through Electrical Wholesalers

1213

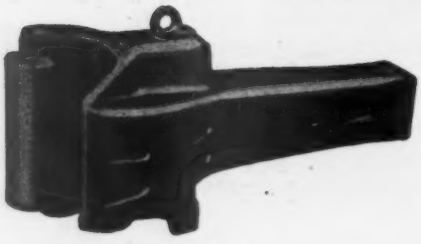
WRITE FOR DATA BULLETIN FOR THE COMPLETE STEELITE SPECIFICATIONS

1. **HOUSING,** heavy gauge, porcelain enamel steel, specially processed to resist corrosive atmospheres; protects reflector against damage from flying particles or rough handling.
2. **REFLECTOR,** multi-conical Alzak aluminum, specially designed for the most exacting, efficient light control; in three arrangements to provide three forms of light distribution.
3. **GLASS COVER,** resists heat; unaffected by severe temperature changes; four times stronger than ¼ inch plate glass; won't shatter under hammer blows!
4. **COVER SEAL,** protects interior from dust, moisture, corrosive gases; special hinged construction, facilitates opening and servicing.

NATIONAL PRODUCTS
FOR RAILROAD EQUIPMENT



Type H Tightlock Coupler, Swivel Casting and Yoke



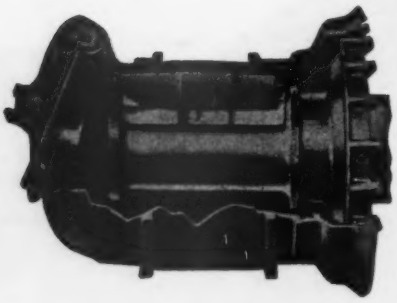
A. A. R. Std. E. Coupler

Naco Spun Steel Car Wheel

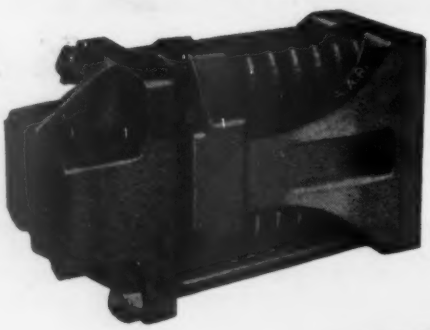
A. A. R. Alternate Std. E. Coupler

A. A. R. Std. Vertical Plane Horizontal Key Yoke

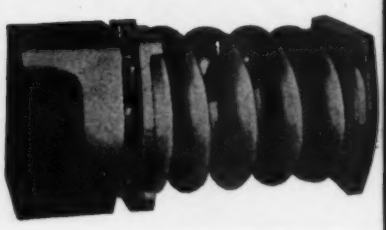
A. A. R. Alternate Std. Vertical Plane Swivel Yoke



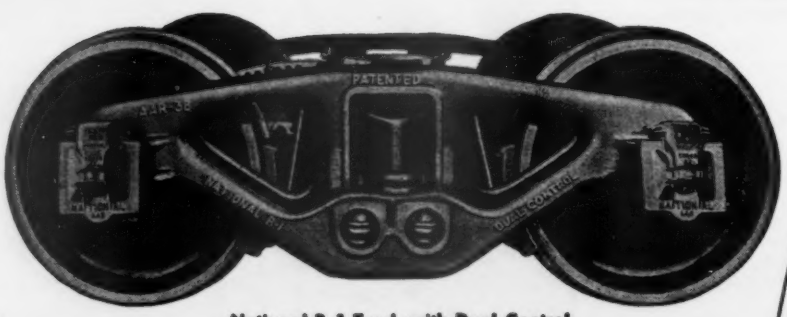
National Journal Box with Deflecting Fan and Flexo No. 2 Lid



M-17-A Draft Gear
A. A. R. Approved



M-50-B Draft Gear
A. A. R. Approved



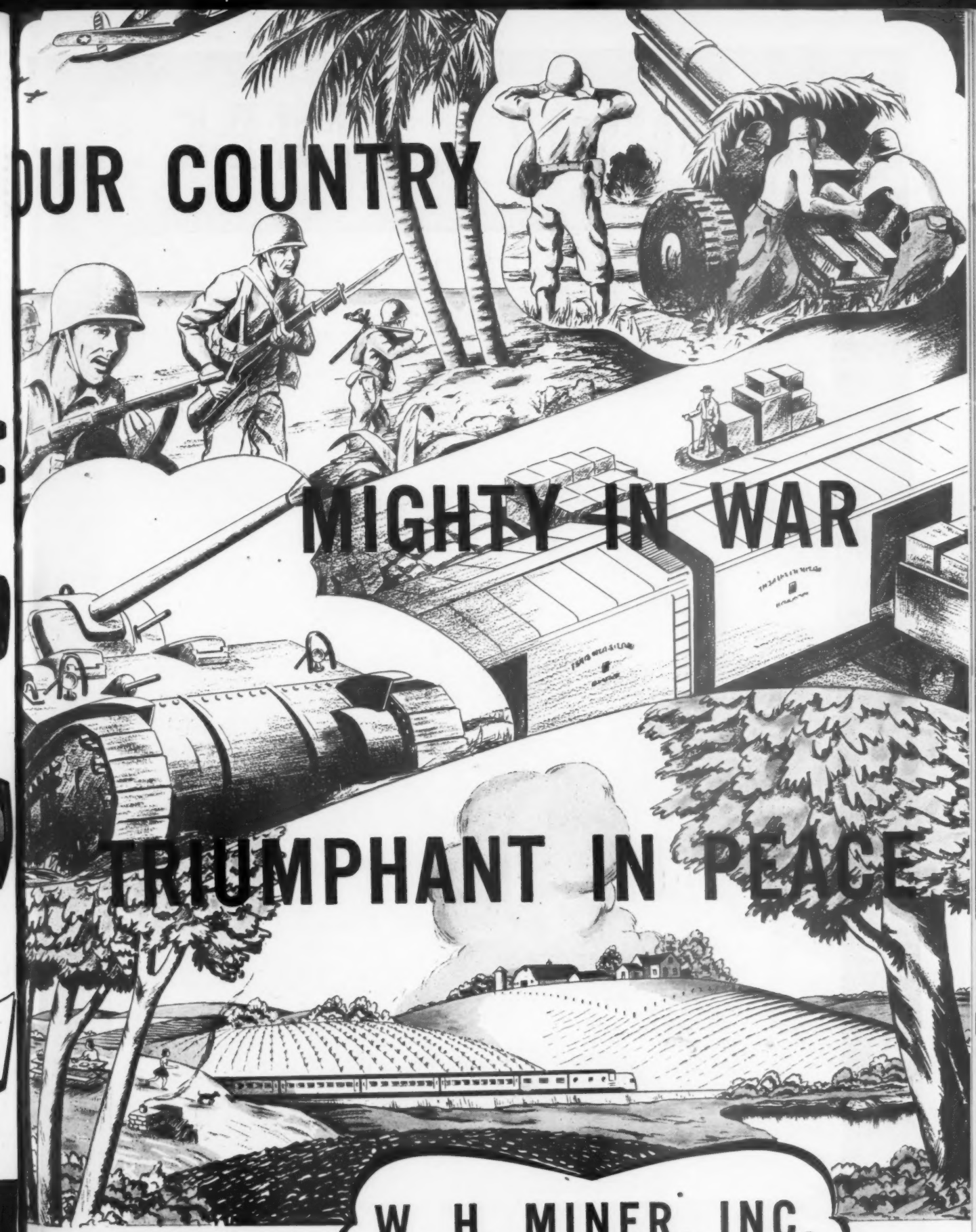
National B-1 Truck with Dual Control

76 YEARS SERVICE
To Transportation

NATIONAL MALLEABLE AND STEEL CASTINGS CO

General Offices: CLEVELAND, OHIO

Sales Offices: New York, Philadelphia, Chicago, St. Louis, San Francisco.
Works: Cleveland, Chicago, Indianapolis, Sharon, Pa., Melrose Park, Ill.



W. H. MINER, INC.
CHICAGO

Unnecessary . . . THEN . . .

WESTINGHOUSE

Westinghouse

FOR OVER SIXTY YEARS
THE BEST KNOWN NAME IN

but *Desirable* . . . NOW

TO PROVIDE CONVENIENCES — EXPECTED BY PASSENGERS

The New Westinghouse Motor Alternator . . . for conversion of direct to alternating current

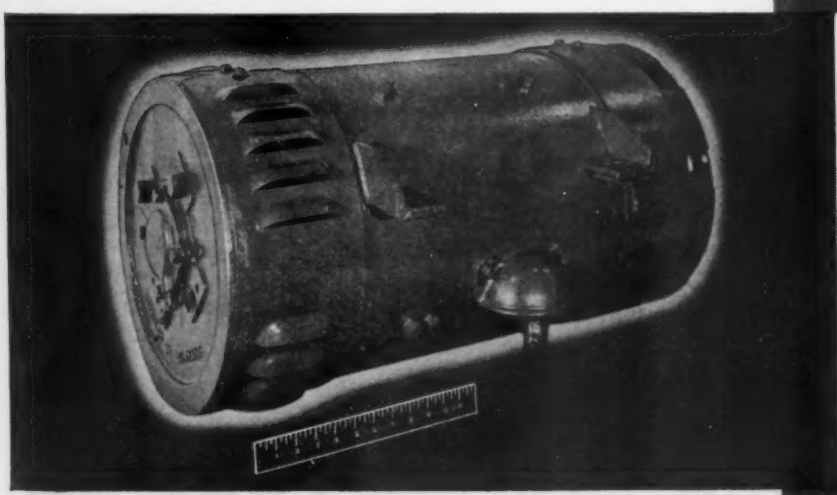
For economical and efficient operation of modern passenger car conveniences, such as fluorescent lighting . . . water coolers . . . Precipitron . . . electric razors and other electrical equipment . . . alternating current is practically a necessity. Modern Railroads find the Westinghouse Motor Alternator indispensable for the conversion of direct current to alternating current.

The Westinghouse Motor Alternator provides power conversion in one package, compact, lighter in weight and giving more power with no increase in size. The Westinghouse Motor Alternator requires no replacement of parts and passes all specification standards for successful power conversion equipment.

Westinghouse design and construction includes all basic features which have been time-tested and demonstrated as essential for highly satisfactory operation in railroad service. Performance meets the unqualified approval of lamp manufacturers as surpassing their rigid requirements established to insure maximum lamp life.

J-95104

CONSULT WESTINGHOUSE . . . ask your Westinghouse office for a copy of "Development of Electrical Equipment for Standard Railroad Passenger Cars—Type WP-21 Motor Alternator", or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.



MODERN RAILROADS DEPEND ON WESTINGHOUSE *Motor Alternator*

Railroad Electrical Equipment

* Trademark Reg. U. S. Pat. Office
by Owens-Corning Fiberglas Corp.

is *Light* in weight

Thermal insulations for Passenger Cars,
Refrigerator Cars, Tank Cars and Locomotives.

Fiberglas is sold to Railroads and Car Builders exclusively by*

G-B MFG. CO. ESTABLISHED 1898

GUSTIN-BACON MFG. COMPANY

KANSAS CITY 7, MISSOURI

New York Philadelphia Chicago Tulsa Houston Fort Worth San Francisco

ILLINOIS CENTRAL

uses the SPICER *Positive* Generator Drive

The Illinois Central
CITY OF MIAMI

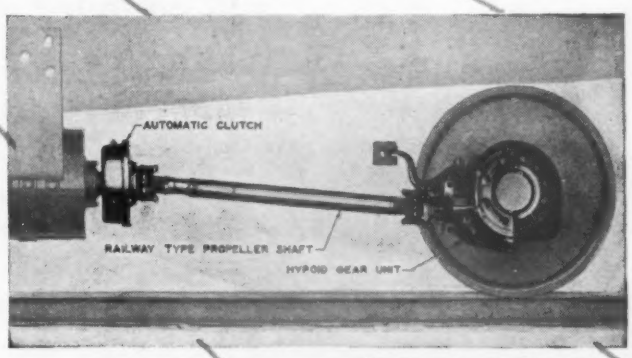
The Illinois Central *City of Miami* is typical of the many American crack trains using Spicer Positive Generator Drives for streamline delivery of steady, dependable generator power to lighting, air conditioning, refrigeration and other equipment.

More than 2000 of these reliable, efficient Spicer Drives are in use by 27 different railroads all over the country!

The modernization of existing cars, and the development of new cars incorporating high standards of passenger comfort, will require increased and more dependable electrical power to operate satisfactorily with the expanded use of air conditioning, improved lighting, electro-mechanical water coolers, radio, electric kitchen equipment, etc., and other improvements to come. Cars will operate generally at higher speeds and will be much quieter and smoother. All of these are factors emphasizing the importance of using a reliable generator drive.

The simple means of applying the Spicer Drive makes it readily adaptable to both old and new cars with few, if any, changes necessary in the car, truck or axle construction.

Other Spicer features include high efficiency and economy, safety, quietness and smoothness. Write for full details and literature describing *all* the profitable advantages Spicer Positive Generator Drives make available to you.



Exterior and cross-section view of Spicer Positive Generator Drive

SPICER *Positive* Generator Drive

Manufactured, Sold and Serviced by

Spicer Manufacturing Corporation, Toledo, Ohio

42 YEARS OF Spicer SERVICE

INSUTAPE and WOVENSTONE'S GREATER EFFICIENCY PROVIDE MORE EFFECTIVE HEATING OF CAR INTERIORS WITH LOWER FUEL CONSUMPTION . . .

For maximum protection of vital piping and steam lines—Insutape and Wovenstone help send steam coursing through piping the length of the longest trains with minimum loss of precious B.T.U.'s! Under post war projected high speed conditions this added protection will be more essential than ever before in providing real passenger comfort—while holding fuel costs down at the same time.

UNION ASBESTOS

MEANS PROGRESS IN INSULATION

AND RUBBER CO.

310 S. MICHIGAN AVE.

NEW ADDED PROTECTION FOR INSUTAPE AGAINST THE WEATHER AND OIL AND FIRE AS WELL! NEOPRENE COATING FOR THE JACKET; AND THE INSULATING FILLER MADE WATER REPELLENT.

ARMY ARMY NAVY

CHICAGO 4, ILLINOIS

Remember those leisurely days when empty freight cars by the hundreds were patiently waiting for days and weeks for their next run?

Times have changed. Now endless trains race their overloads across country without a breathing spell and bearing failure may mean the difference between making and missing port connections.

The wear-resistance and easy-running smoothness of N-B-M Journal Bearings is your best protection from premature lay-offs. Standardize on

N•B•M

JOURNAL BEARINGS

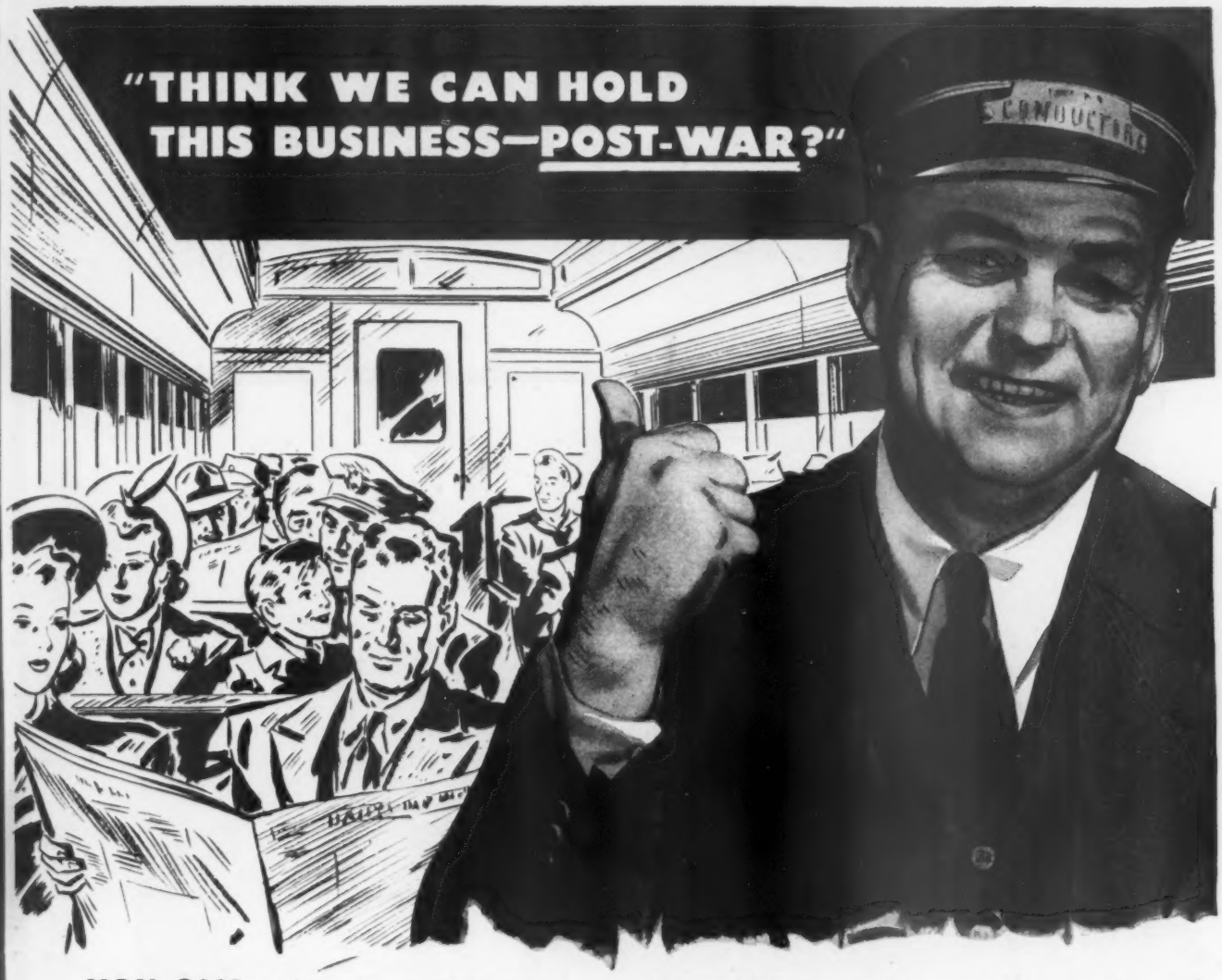
NATIONAL BEARING

DIVISION

ST. LOUIS • NEW YORK

AMERICAN Brake Shoe COMPANY

PLANTS IN: ST. LOUIS, MO. • PITTSBURGH, PA. • MEADVILLE, PA. • JERSEY CITY, N. J. • PORTSMOUTH, VA. • ST. PAUL, MINN. • CHICAGO, ILL.



YOU CAN—with air conditioning and the new kind of comfort Sturtevant offers!

FOR EXAMPLE — the "peaks and valleys" of earlier air conditioning have been leveled off by the new Sturtevant Compressor-Condenser. It is equipped with unloading valves which cut in or cut out a portion of the compressor cylinders, depending upon refrigeration requirements. The divided Fan-Evaporator is synchronized to cut its output to correspond to compressor output.

This means the Sturtevant System is always in operation—but generally at less than full load. And continuous operation—instead of the hourly 10 to 12 cycles of "full on" or "full off", common to other systems means no humidity and temperature fluctuations from "too hot" to "too clammy". Moreover, this lessens wear on equipment and reduces maintenance chores.

STURTEVANT HAS MORE

Other improved Sturtevant equipment waiting for you includes, the dry surface Condenser, the Motor-Compressor Unit and the Evaporative Condenser Unit, using spray water. These can be engineered to dovetail with your precise needs for complete air-conditioning, either ice-activated or mechanical.

Sturtevant Engineers are ready to lend a hand . . . opening new avenues to profit and lower operating costs. Why not arrange now to talk with a Sturtevant Engineer along these lines?

B. F. STURTEVANT COMPANY
HYDE PARK BOSTON 36, MASS.
Branch Offices in Principal Cities

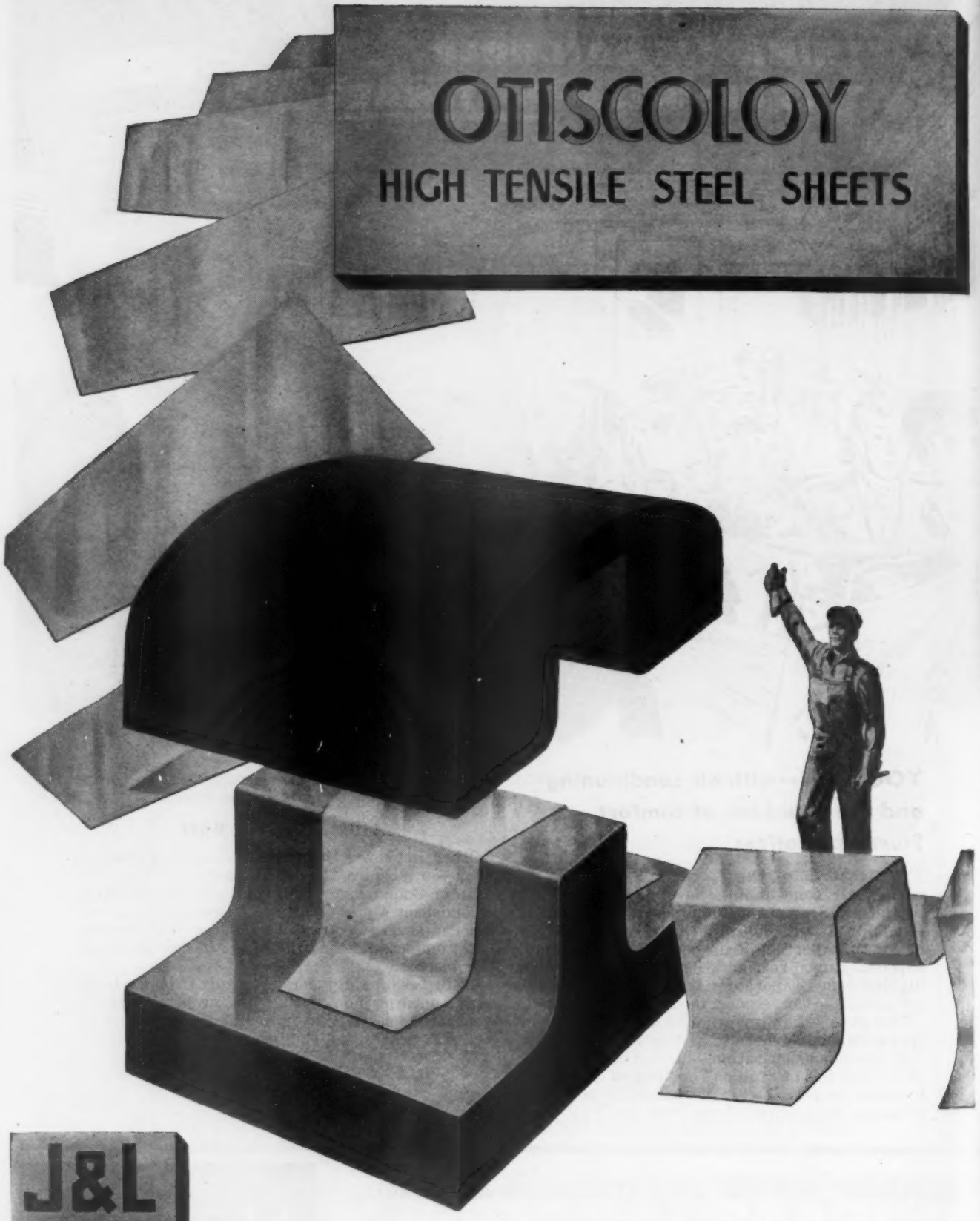
STURTEVANT GIVES YOU ALL 4 RAILROADING ADVANTAGES

1. More uniform temperature and humidity conditions in the car.
2. Equipment designed for easy maintenance.
3. Equipment designed for minimum space and weight.
4. Equipment that requires a minimum power load.

Sturtevant
REG. U.S. PAT. OFF.
Puts Air to Work

STURTEVANT "Railvane" Units or Systems are used by 40 railroads and are covered by more than 80 issued patents and patents pending

OTISCOLOY
HIGH TENSILE STEEL SHEETS



J&L STEEL

A high strength steel that is easily fabricated and readily welded. May be hot or cold formed. Affords reductions in weight . . . its greater strength permits use of lighter gauges. Resists corrosion. Otiscoloy available in both sheets and plates for a wide variety of applications.

JONES & LAUGHLIN STEEL CORPORATION
PITTSBURGH 30, PENNSYLVANIA

A NEW, IMPROVED LID...

The Symington

COMPOSITE ARTICULATED

JOURNAL BOX LID

FEATURES

- ★ Light weight—yet sturdy
- ★ Tight Joint
- ★ Center Pressure
- ★ Full Articulation
- ★ Easy to apply and remove

For full details send for Bulletin describing the B-265 Lid.

THE SYMINGTON-GOULD CORPORATION

Works ROCHESTER & DEPEW, NEW YORK

New York • Chicago • St Louis • Baltimore • Boston • San Francisco • *In Canada* ADANAC SUPPLIES, LTD. Montreal, Que.

● *Houdaille engineers know the answers to scores of problems involving vibration control — and constantly are engaged in solving new ones.

Millions of Houdaille hydraulic instruments absorb the bound and rebound, the side-sway, the shimmying forces, which attack cars, trains and planes.

Out of this rich experience, we have been called upon to design energy-absorbing devices to control vibration on machine tools, crushing machines, power presses, drilling equipment, knitting machines, engine mountings . . . even the "water hammer" in pipe lines.

This advertisement is an open invitation to submit vibration problems of any kind to us. We shall be glad to share our experience with you.

HOUDE ENGINEERING DIVISION OF
HOUDAILLE-HERSHEY CORPORATION
MAKERS OF HYDRAULIC CONTROLS
BUFFALO 11, NEW YORK

*Pronounced—Hoo-dye

LATEST REPORT

ON AMERICA'S FIRST ALUMINUM BOXCAR

Built by Great Northern with Alcoa Aluminum

WESTERN UNION

(54)

CLASS OF SERVICE

This is a full-rate Telegram or Cablegram, unless its deferred character is indicated by a suitable symbol above or preceding the address.

SYMBOLS

DL = Day Letter
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LC = Deferred Cable
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J O CHESLEY ALUM CO OF AM =
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GREAT NORTHERN EXPERIMENTAL ALUMINUM BOXCAR #2500 THE FIRST ALUMINUM BOXCAR IN AMERICA HAS JUST COMPLETED 254 DAYS SERVICE OF WHICH 204 DAYS WERE ON FAST PASSENGER TRAINS BETWEEN CHICAGO TWIN CITIES AND WEST COAST AND BALANCE IN INTERLINE SERVICE. TOTAL MILEAGE APPROXIMATELY 104,000 MILES USED TO CARRY SPECIAL EXPRESS INSPECTION SHOWS CONDITION PERFECT =

E T HUTCHINSON.

#2500 254 204 104,000.

ALCOA FIRST IN ALUMINUM

ALCOA
ALUMINUM

You can *cut* this bolster spring action

DOWN to this

This is what Oscillation Curves prove about the movement of your spring groups in operation.

A.A.R. STANDARD SPRING GROUP

HOLLAND SNUBBER SPRING AND 3 A.A.R. SPRINGS

Style A-6-A Holland *Volute* Snubber Springs

HOLLAND COMPANY

332 SOUTH MICHIGAN AVENUE, CHICAGO, ILLINOIS

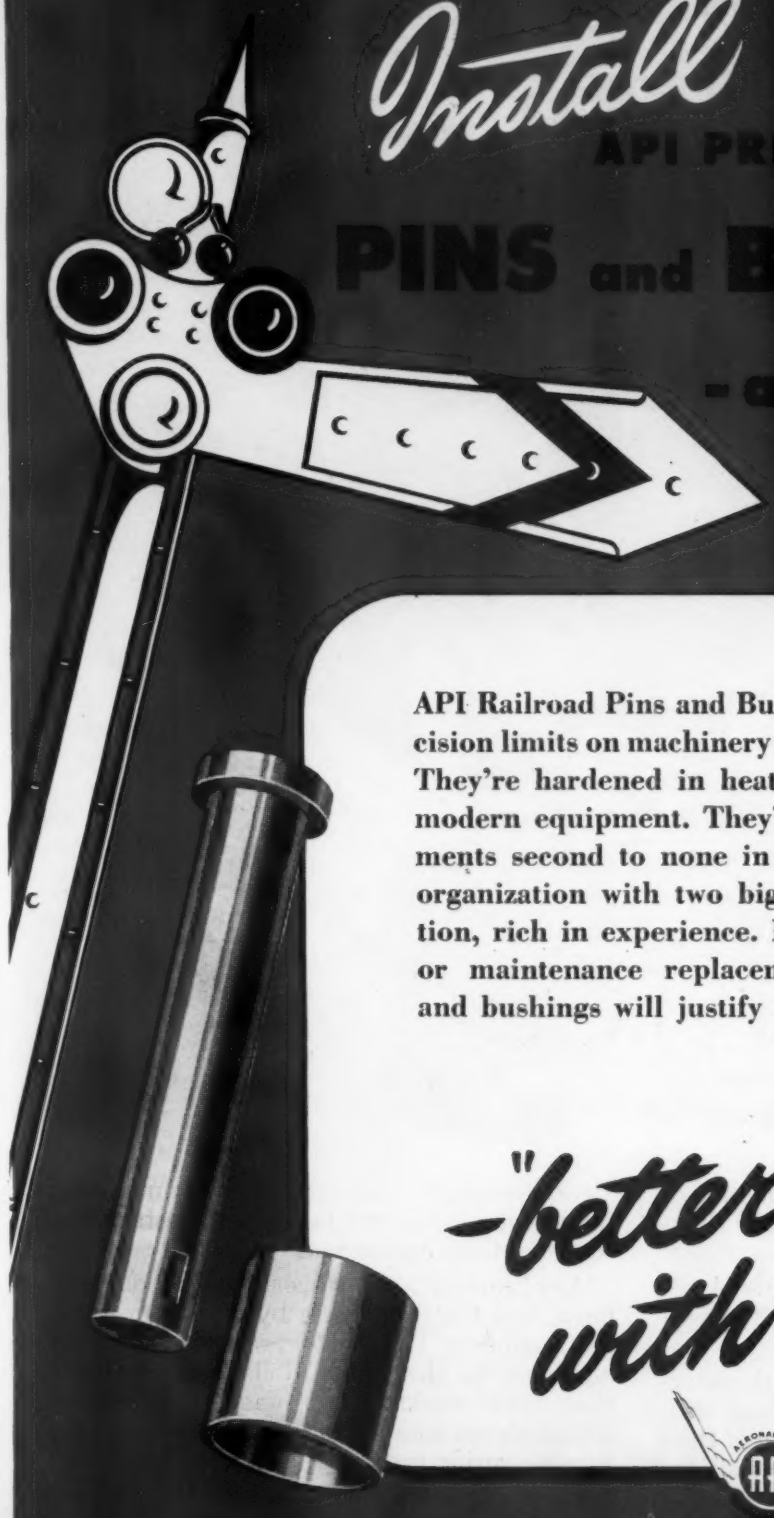
TRAVEL A SAFE COURSE

Install

API PRECISION-GROUND

PINS and BUSHINGS

- and forget 'em!



API Railroad Pins and Bushings are ground to precision limits on machinery geared for long, fast runs. They're hardened in heat-treat by America's most modern equipment. They're inspected with instruments second to none in the industry. All in *one* organization with two big plants tooled to perfection, rich in experience. If it's original equipment or maintenance replacement, API railroad pins and bushings will justify your confidence in them.

"better talk with API"

AERONAUTICAL PRODUCTS, Inc.

Detroit Plant and Administrative Offices: Detroit 12, Michigan

Ohio Plant: Washington Court House, Ohio

There may be a Diesel locomotive... a power shovel or a loom in this room

Section of Hyatt Engineering Laboratory. At right—One of many test fixtures. Hyatt bearing being given an endurance test.

EACH DIFFERENT TYPE of application makes its own special demands of Hyatt Roller Bearings—with such destructive forces as speed, impact, radial or thrust loads, and others—as well as conditions of moisture, wetness, heat, cold, dust, dirt.

It is traditional to build Hyatts with endurance to outlast the equipment for which they are designed. Our way of making sure of their capacity to do so is to simulate the conditions of the job—whether it's that of a massive locomotive journal box or a feather-weight, high-speed spindle on a textile loom—in our 24-hour-a-day testing laboratory.

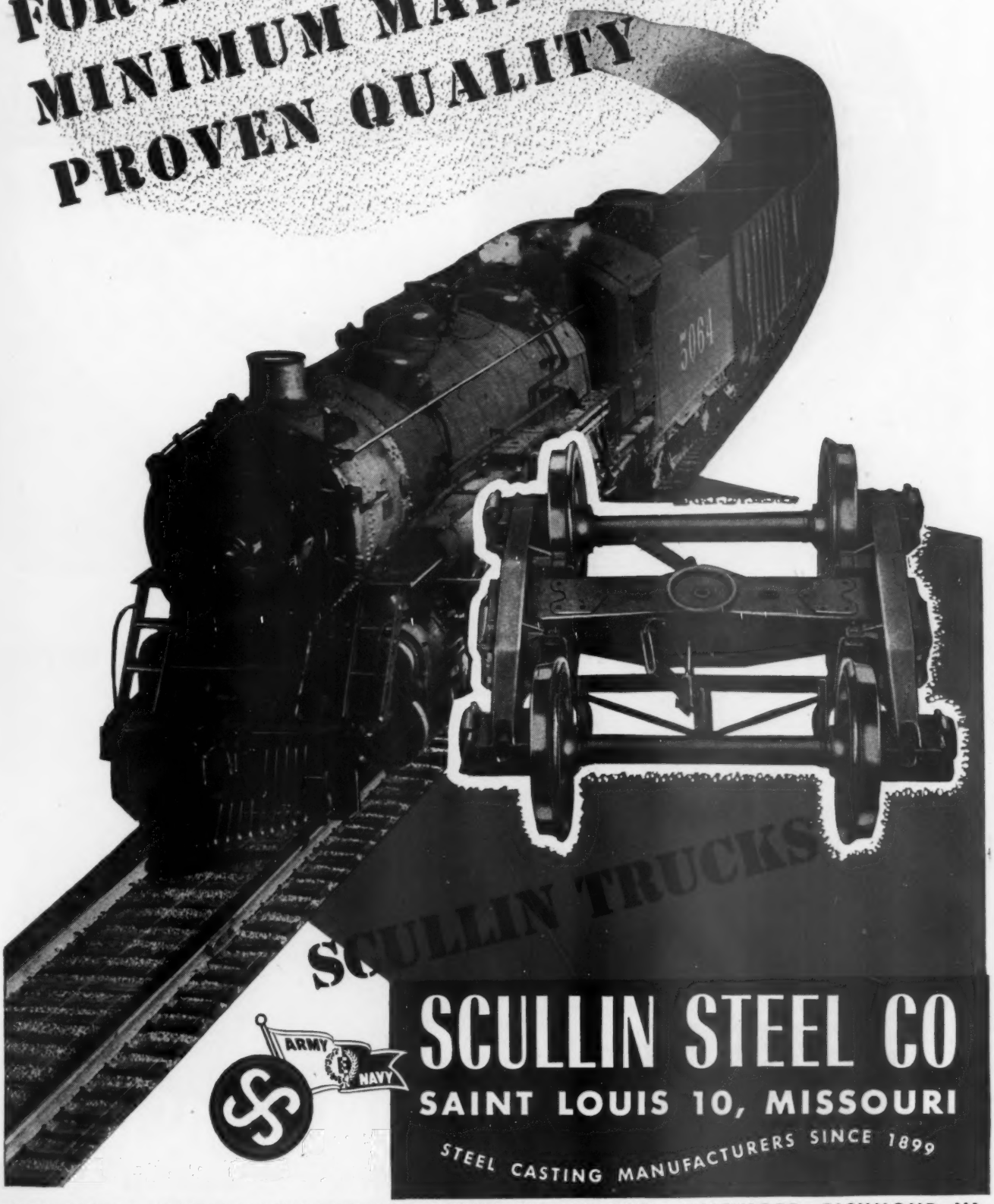
Here, dozens of individual tests go on all the time—even to running bearings to destruction to prove their correctness of design.

Any bearing, in any stage of production may be picked for these tests by Hyatt's roving test engineers. This random selection is added assurance to the Hyatt Roller Bearing user that both workmanship and metallurgical standards are adhered to throughout the entire manufacturing process.

Hyatt engineers gladly consult with you on the selection of the proper Hyatt Roller Bearings for your product. Hyatt Bearings Division, General Motors Corporation, Harrison, N. J.

HYATT ROLLER BEARINGS

FOR DEPENDABLE SERVICE
MINIMUM MAINTENANCE
PROVEN QUALITY



SCULLIN TRUCKS

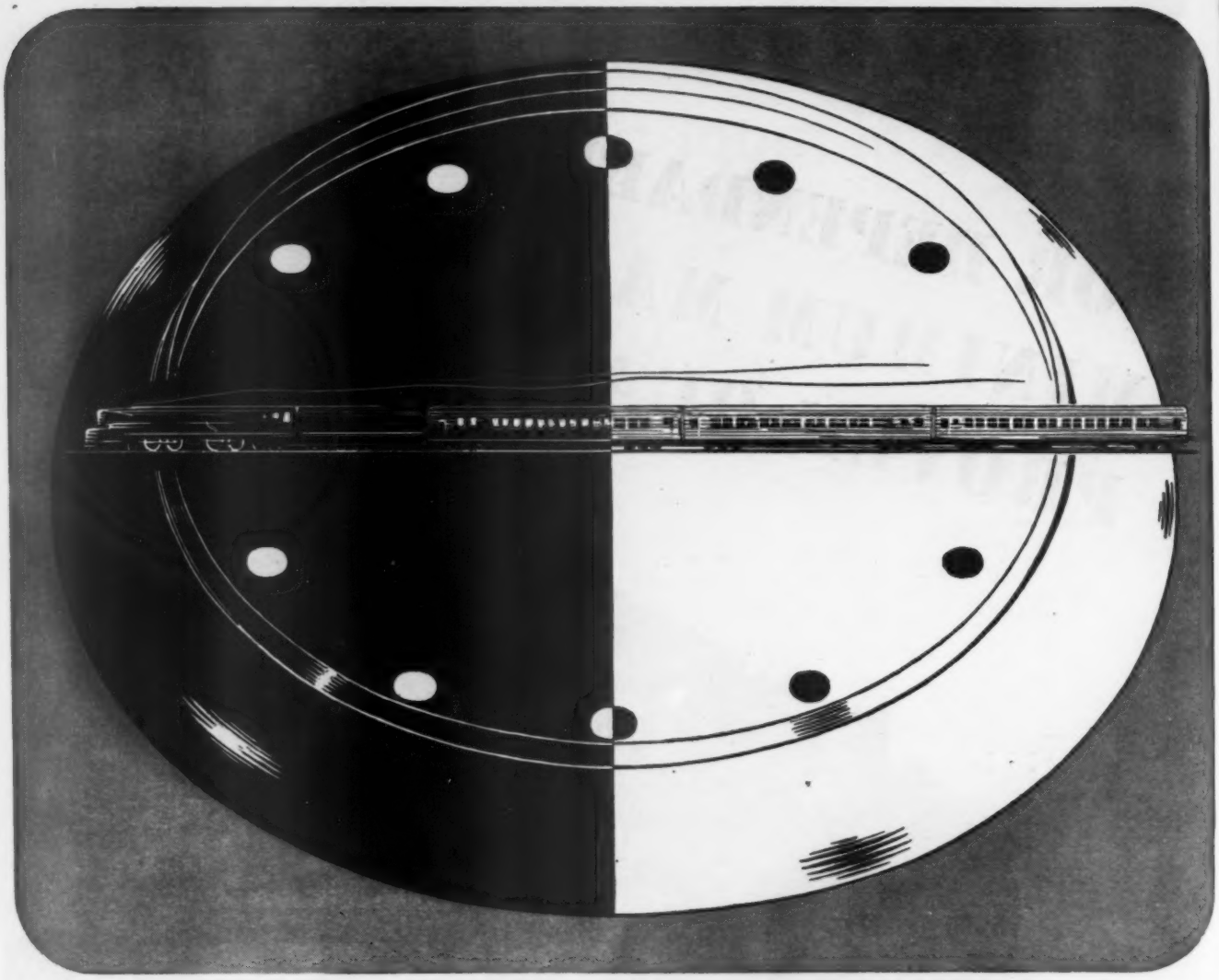
ARMY NAVY

SCULLIN STEEL CO

SAINT LOUIS 10, MISSOURI

STEEL CASTING MANUFACTURERS SINCE 1899

NEW YORK • CHICAGO • PHILADELPHIA • CLEVELAND • ST. PAUL • BALTIMORE • RICHMOND, VA.



Exide — ON 24-HOUR DUTY IN TRANSCONTINENTAL SERVICE

SINCE 1891, Exides have been serving America's railroads with dependability, long-life and ease of maintenance. And on the luxurious, new cars planned for tomorrow, there will be the finest batteries Exide ever made. When you buy an Exide, you *Buy* to *Last.*

ARMY E NAVY

Exide
BATTERIES

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

ONLY GETTING 50 gallons OF OIL FROM A 50 gallon Drum?

You get HUNDREDS if you use THE YM OIL RECLAIMER!

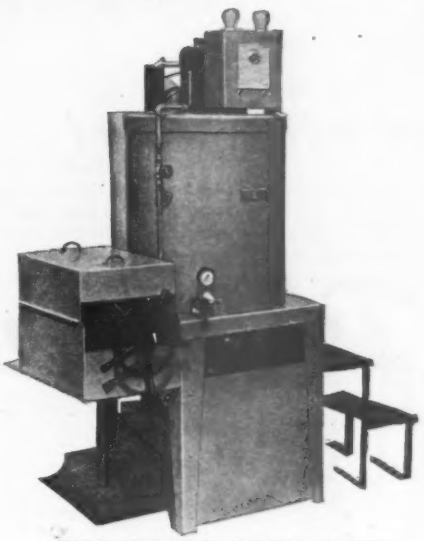
With the YM Oil Reclaimer, you can put used oil back to work...can use it again and again...and it's interchangeable with new parent oil!

The YM Oil Reclaimer completely removes fuel dilution...and moisture too, of course. It removes acids, gum, asphaltic materials. The oil comes out of the Reclaimer clear and sparkling—restored to the original viscosity of the new parent oil.

Oil refined in the YM reclaimer displays outstanding anti-varnish qualities. It cleans—*and keeps clean*—crank cases, valve chests and other places where sludge may collect.

Diesel and gasoline engine oils — transformer oils — cutting oils — hydraulic cylinder oils — these are just a few of the types that can be successfully reclaimed in a YM unit.

We'll be glad to show you how the YM reclaimer can cut *your* oil costs—and to tell you the names of companies near you who *know* what YM can do.



THE YM OIL RECLAIMER
One of the new models of the YM Reclaimer — available in a range of sizes for varying capacity requirements.

THE YOUNGSTOWN MILLER COMPANY

A Subsidiary of
Walter Kidde & Company, Inc.
672 Main Street, Belleville 9, N. J.

Save OIL...and you save MONEY
with the **YM OIL RECLAIMER**
MAIL THE COUPON FOR FULL DETAILS

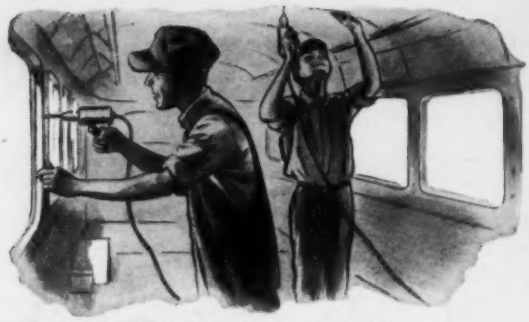
The Youngstown Miller Company
672 Main Street
Belleville 9, N. J.

Gentlemen:
Please send me further details about the YM Oil Reclaimer—and names of users in this locality.

Name.....
Position.....
Company.....
Street Address.....
City and State.....

BURRS NO LONGER SNAG!

Before Phillips Recessed Head Screws were used for trim and seat assembly in this motor bus, burrs on slotted screws snagged passengers' clothing, caused many nuisance complaints. In spite of extra time for slow hand driving, and smoothing heads, some burrs got by.



NO ASSEMBLY LAG!

With Phillips Screws, burr-trouble ended, and *savings* began – as much as 40% in assembly time and labor, because power driving became practical. Also saved was the time formerly wasted disassembling, refinishing, and reassembling parts scarred by driver skids.

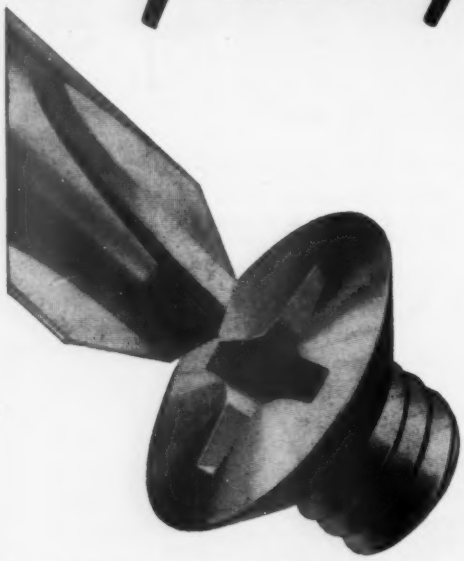
PLANS GET O.K. TAG!

Because Phillips Recessed Head Screws take heavier driving pressures without danger of burring, driver skids, or slant driving, fastenings are stronger, more rigid than with slotted screws. Designers are freed of slotted head handicaps, can often reduce number of screws needed.

APPROVAL'S "IN THE BAG"!

Burr-free Phillips Screws are not only kind to clothing . . . the Recessed Head on exposed surfaces looks better, blends with the practical smartness of modern design. Give your product this cost-trimming, customer pleasing sales appeal!

It's Phillips — the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
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Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
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Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.

Sylphon

Heating and Air Conditioning Controls

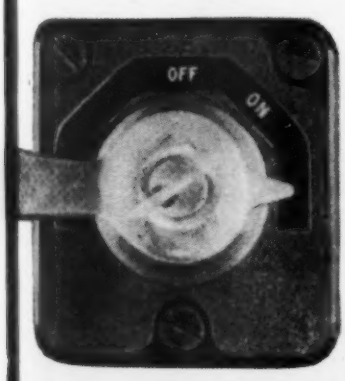
for Simplicity

Switch Pos.	Circuit Closed									
	1	2	3	4	5	6	7	8	9	10
On	•	•	•					•		•
Off				•		•	•			

Schematic wiring diagram for the amplified heating and air conditioning control panel

★ *No relays required in heating control circuit—only one relay required in cooling circuit.*

POST-WAR

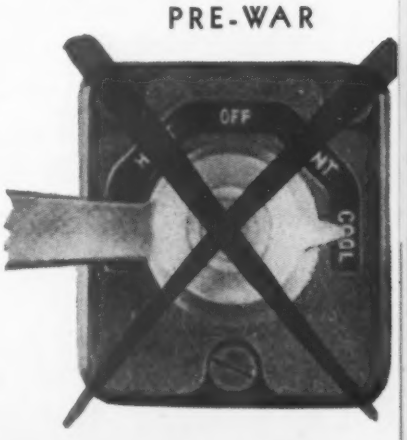


THE Sylphon master control panel is simplicity itself. Conditions for heating — cooling or vent are automatically selected — independent of the train crew operation. All cars in the train operate under similar conditions. Parking protection provided in OFF position.

The Sylphon Control System is installed on more than 600 passenger cars and is rendering a most satisfactory service on some of the most difficult runs in this country.

Write for reprint No. 145. This fully describes the automatic panel.

PRE-WAR



THE FULTON SYLPHON COMPANY

TRANSPORTATION CONTROLS DIVISION

DREXEL BUILDING • PHILADELPHIA 6, PA.

One of the two 8 cylinder diesels that power this new 2000 HP locomotive. Arrows show the Nugent Lube Oil Filters that keep oil practically 100% clean.

NEW 2,000 H. P. LOCOMOTIVE USES NUGENT FILTERS

for cleaner oil, greater efficiency

This new 2000 HP diesel locomotive for both freight and passenger service is driven by two 8 cylinder diesel engines. Each engine has two Nugent Lube Oil Filters, for thorough protection against dirt and foreign matter in the lubricating oil.

Nugent filter protection increases engine efficiency, prevents trouble by removing dirt particles to insure virtually 100% clean oil. Nugent filters have 20 times more filtering area than most filters of comparable size. Write today for bulletin 7A which gives full details.

NUGENT FUEL OIL FILTER

1576 engine hours on one recharge set!

FIG. 1116SV-D

In a recent test, a 900 HP diesel switcher operated 1576 engine hours before it was necessary to replace the absorbent filter recharge in its Nugent Duplex Fuel Oil Filters. Proof indeed, is this, of Nugent economy.

DISTRIBUTORS

Industrial Equipment Co., 6435 Hamilton Ave., Detroit, Mich.
H. J. Kelly, 816 Howard Ave., New Orleans, La.
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Dallas S. Deem, 1215 So. St. Louis Ave., Tulsa, Okla.
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Nugent Filters

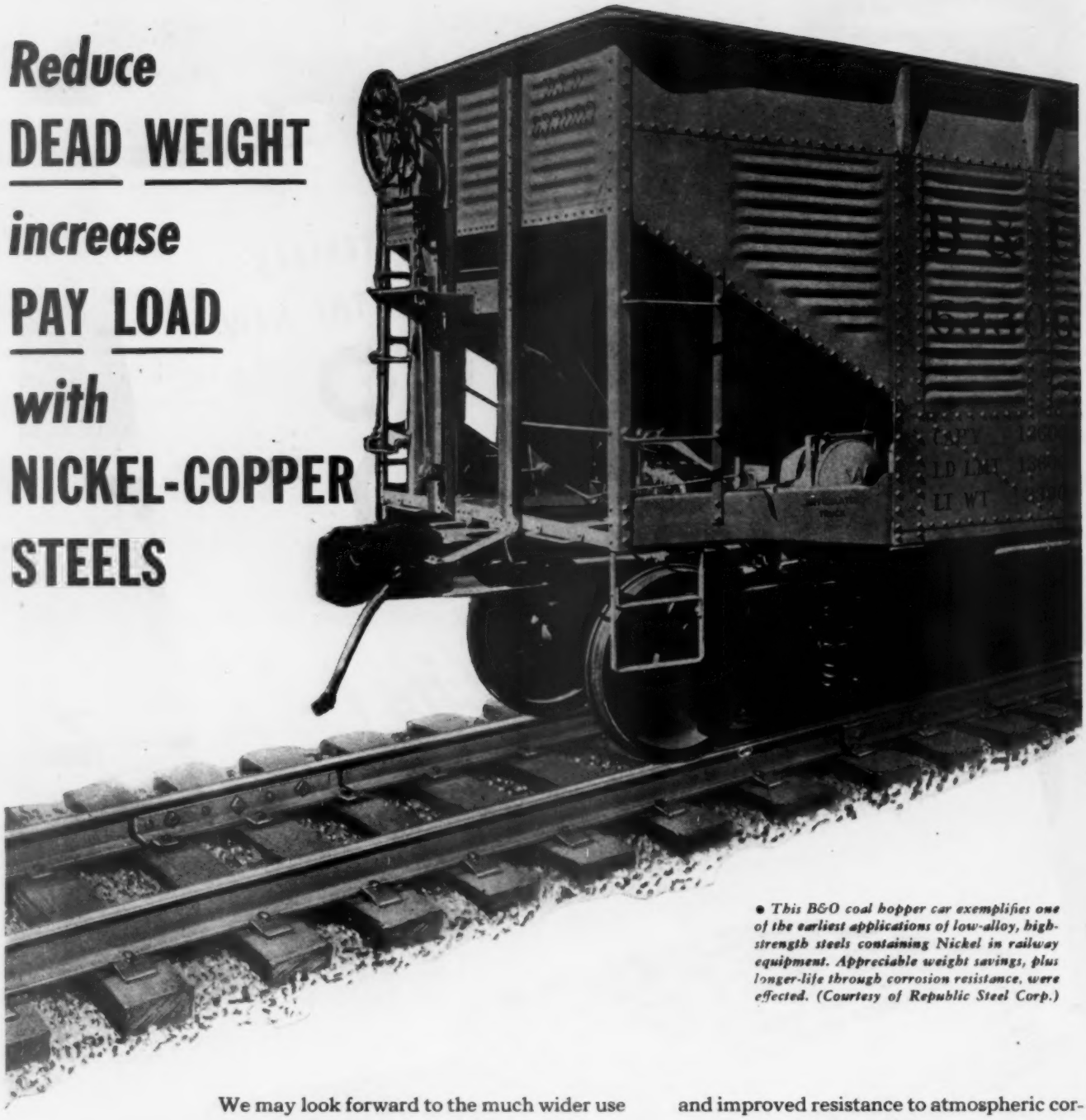
ESTABLISHED 1897

WM. W. NUGENT & CO., INC.
431 N. HERMITAGE AVE. CHICAGO 22, ILLINOIS

- Fuel Oil Filters
- Lube Oil Filters
- Lubricating Systems
- Sight Flow Indicators
- Filter Bags

FOR YOUR TOUGHEST MATERIALS HANDLING JOBS . . . SPECIFY THE NEW
PHILCO "THIRTY"
-with 30% Longer Life!
The tougher the jobs, the better this new Philco "Thirty" Storage Battery shows up. For long ramps and heavy loads — Philco "Thirty" delivers the power. And — in addition — it gives 30% longer life! Write today for the new Philco "Thirty" catalog.
The new Philco "Thirty" for electric industrial trucks is identified by its distinctive red connectors.
PHILCO
CORPORATION
STORAGE BATTERY DIVISION
TRENTON 7, NEW JERSEY
FOR 50 YEARS A LEADER IN INDUSTRIAL STORAGE BATTERY DEVELOPMENT

Reduce DEAD WEIGHT *increase* PAY LOAD *with* NICKEL-COPPER STEELS



• *This B&O coal hopper car exemplifies one of the earliest applications of low-alloy, high-strength steels containing Nickel in railway equipment. Appreciable weight savings, plus longer-life through corrosion resistance, were effected. (Courtesy of Republic Steel Corp.)*

We may look forward to the much wider use of low alloy, high-strength steels in railroad equipment where weight saving and durability are prime requisites. These steels have reduced dead weight and increased pay load.

In selecting alloy steels, advantage and economy may be realized by the use of the high-strength Nickel-copper steels.

They offer greater strength and stamina and improved resistance to atmospheric corrosion. Their good welding properties and ductility permit easier, faster fabrication. Their greater impact strength, even at very low temperatures, assures dependable performance in arctic cold or desert heat.

Counsel and data on the selection and fabrication of alloy steels for railway equipment may be obtained from our technical staff. Your inquiries are invited.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

YOU CAN'T DO BETTER THAN *"SPECIFY ROL-MAN"*

Labor and time-out-of-service cost for replacing pins, bushings and wear plates, so dwarfs the actual cost of these parts that the best is never too good. Replace with Rol-man and they are "in place" for many years.

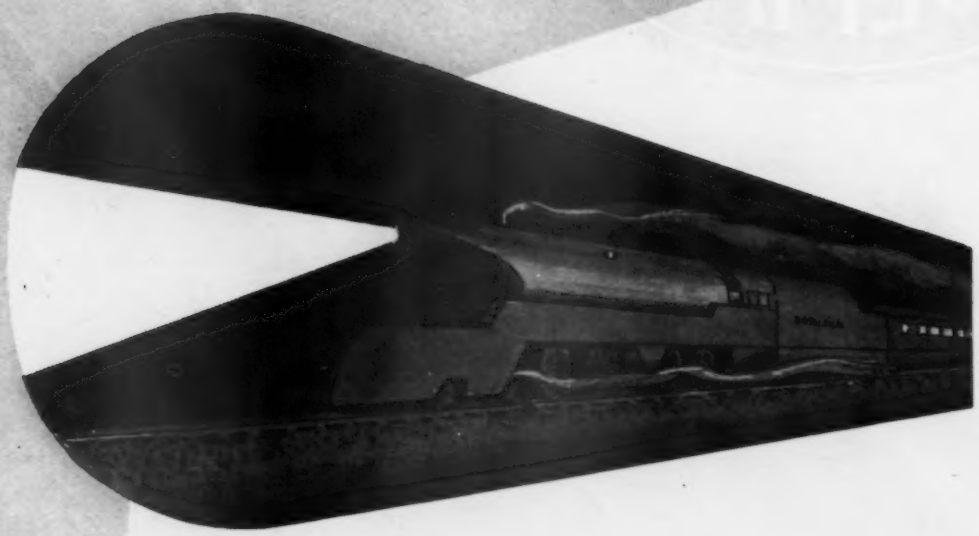
If you specify Rol-man for new cars or locomotives, you're going the limit to keep them out of the shop, for a long, long time.

Manganese Steel Forge Co., 2813 Castor Ave., Philadelphia 34, Pa.

Rol-man has been serving leading railroads for over 20 years.

PINS
BUSHINGS
WEAR PLATES

Rol-Man Pins and Bushings are ground to precision diameters. Wear Plates are fabricated to your specifications, ready for installation.



for Car Lighting and Headlighting

See Electric Service

DESIGNERS,
ILLUMINATION ENGINEERS
and MANUFACTURERS

ELECTRIC SERVICE MANUFACTURING CO.

Former Name—Electric Service Supplies Co.

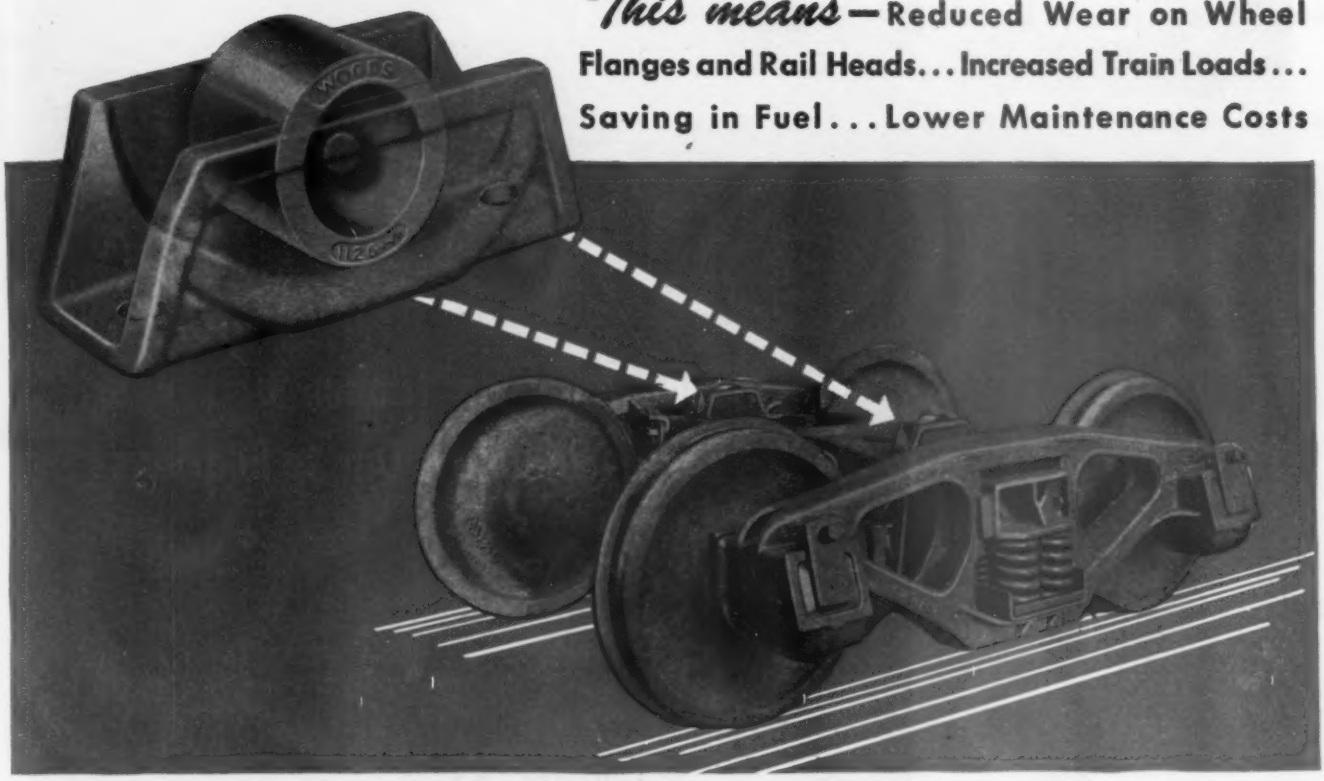
17th & CAMBRIA STREETS • PHILADELPHIA 32 • PA. • Branches in Principal Cities

Permits Free Movement of Car Trucks on Curves

EDWIN S. WOODS & COMPANY

NO. 1126 Forged Steel Roller Side Bearings

This means—Reduced Wear on Wheel Flanges and Rail Heads... Increased Train Loads... Saving in Fuel... Lower Maintenance Costs



The Edwin S. Woods No. 1126 Forged Steel Roller Side Bearing consists of only two parts, the housing and the roller.

The housing is made of special forging quality S.A.E. steel, and heat treated to insure a high Brinell.

The roller is forged from special forging quality S.A.E. steel, heat treated and oil quenched and is centered by gravity. This rugged two-piece construction feature allows a minimum of clearance between the housing side walls and the roller, thus assuring a true position of the roller at all times.

The web and rim construction not only permits complete heat treatment, but also allows for a lighter and stronger A.A.R. bearing for all types of rolling stock.

Keep transportation going with all possible savings . . . keep more traffic rolling more economically by equipping all your rolling stock with Woods Roller Side Bearings.

LONGER LIFE—LESS REPLACEMENT OF SIDE BEARINGS

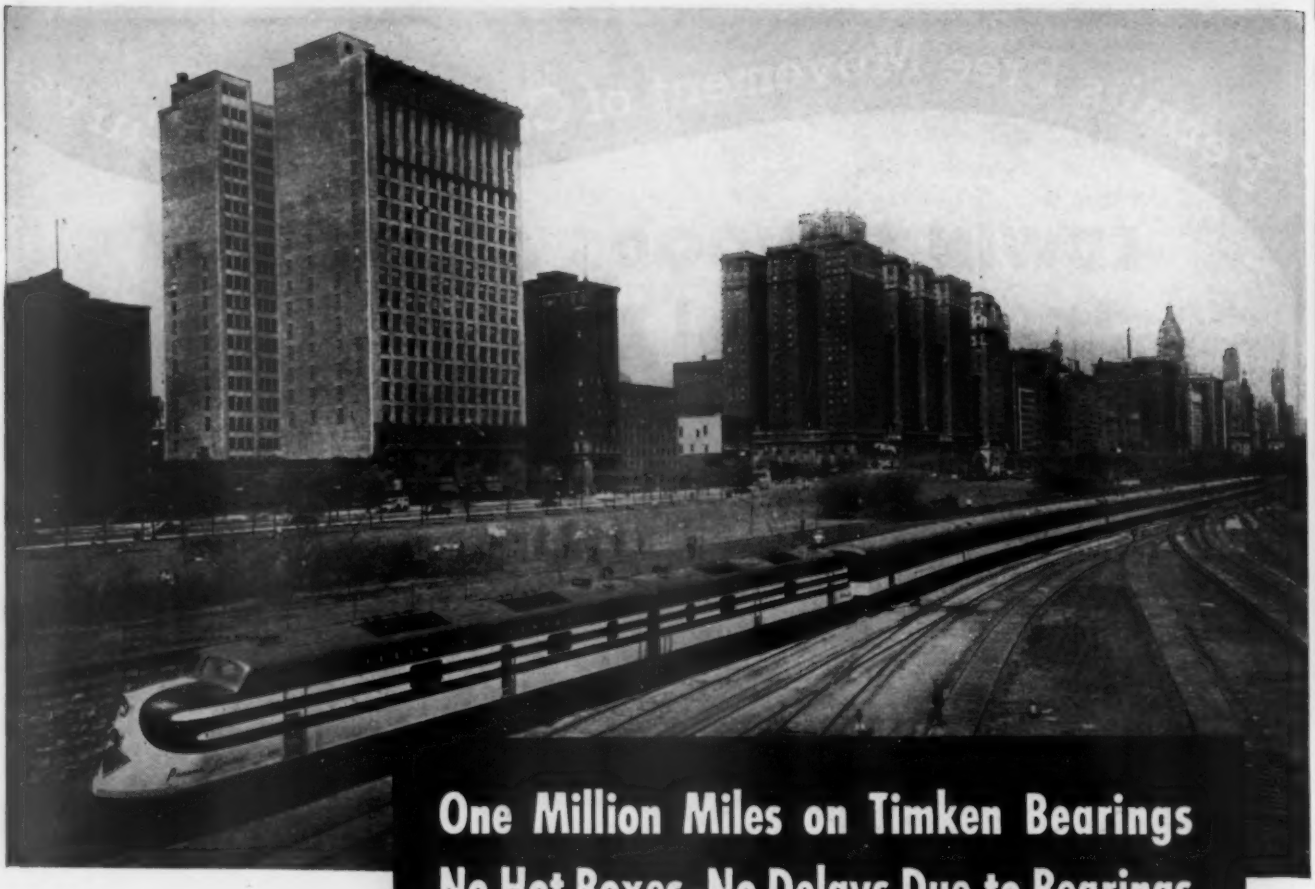
In order to obtain maximum hardness and toughness, important to long-lived wearing properties, roller bearings are heat treated. Because of the Woods' recessed roller design, with its rim and web construction, proper equalization of metal structure is obtained throughout by heat treatment. *Write for Bulletin.*

EDWIN S. WOODS & COMPANY Division of

Quality Since 1880

PETTIBONE MULLIKEN CORPORATION

4710 West Division Street, Chicago 51, Illinois

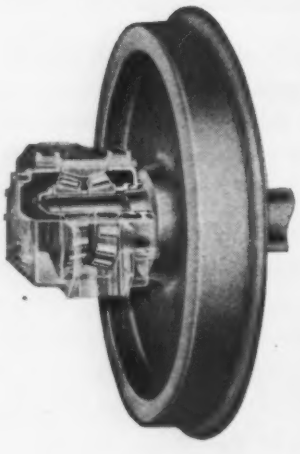


One Million Miles on Timken Bearings
No Hot Boxes-No Delays Due to Bearings

The Chicago-New Orleans "Panama Limited" of the Illinois Central Railroad recently completed 3 years of service without a single hot box or delay of any kind due to journal bearings.

These two Pullman-built trains — youngest of America's sleeping-car streamliners—are equipped with Timken Roller Bearings on all car journals. Each car has gone 1,000,000 miles.

Meanwhile many other American streamlined trains, with many more years of service to their credit, continue to roll up phenomenal trouble-free mileages on Timken Bearings.



TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
RAILWAY ROLLER BEARINGS

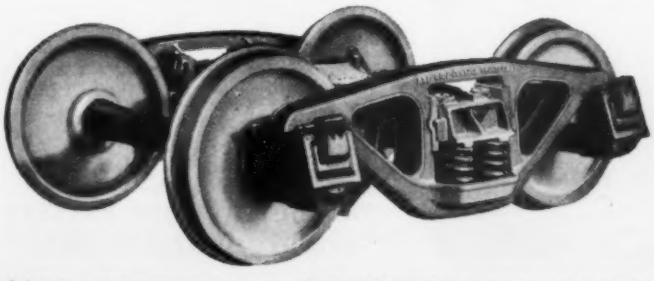
THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

*More than 50,000 closely charted miles of performance testing and over forty years of design, development, and production experience are combined in the A.S.F. Ride-Control Truck (A-3)**

MINT-MARK OF ⬡ FINE CAST STEEL

**The modern truck for every type of freight service at any speed and under all loads.

A·S·F *Ride-Control* TRUCK



LONG SPRING TRAVEL · CONSTANT FRICTION CONTROL

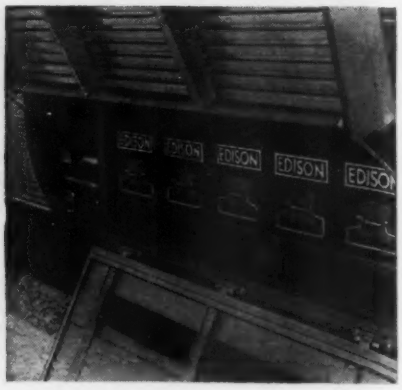
AMERICAN STEEL FOUNDRIES

CHICAGO

WEIGHT GOES DOWN...

DEPENDABILITY UP...

when Alkaline Batteries Go IN ➡ ➡ ➡



Not only are Edison Alkaline Batteries the lightest weight type of battery available for railway-car service but their use saves weight where it counts most – near the middle of the car. The larger the kilowatt-hour capacity, the greater is the weight that can be saved by equipping cars with alkaline batteries.

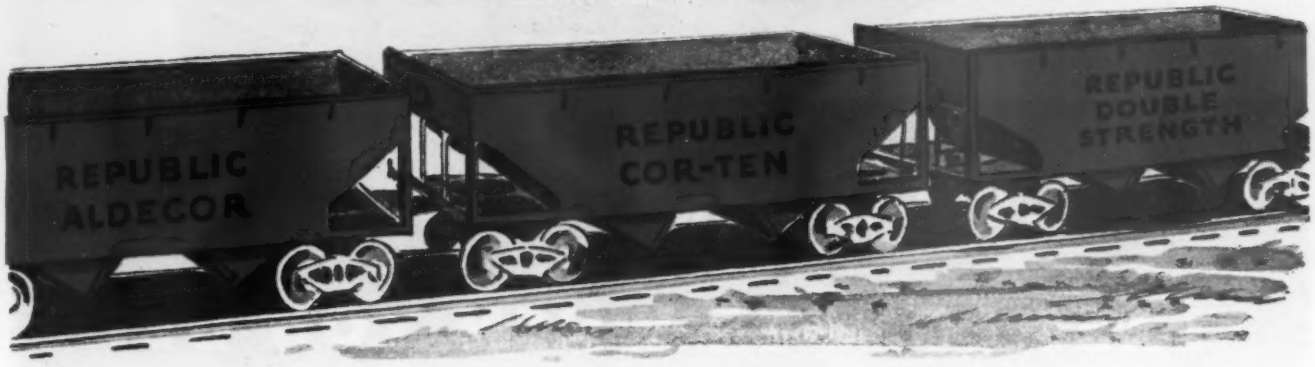
An outstanding reason for their light weight advantage is their high-strength steel cell construction. This, together with their fool-proof electrochemical principle of operation give alkaline batteries unequaled dependability. You can have no better insurance of adequate capacity for operating the electrical luxuries and conveniences you provide for passenger comfort on post-war cars. Alkaline batteries have a long record of highly dependable service in 32-volt, 64-volt and 110-volt systems. *Edison Storage Battery Division of Thomas A. Edison, Incorporated, West Orange, New Jersey.*

Electrical features being planned for superlative passenger comfort and convenience on post-war cars emphasize the advantages of using batteries that can provide increased capacity with least additional weight and with greatest inherent dependability of operation. All of these requirements are met by Edison Alkaline Batteries.

Edison

THE LIGHTWEIGHT BATTERY
FOR LIGHTWEIGHT CARS

3 HIGH STRENGTH STEELS with one common objective – *Light Weight at Low Cost*



Never has weight reduction been a more important factor in new freight and passenger car design than it is today. And Republic simplifies your selection of a low-cost, weight-saving material by providing a COMPLETE line of High Strength Steels — ALDECOR, COR-TEN and REPUBLIC DOUBLE STRENGTH.

In most respects, these three low-alloy steels have much in common. All three possess a minimum yield strength of 50,000 lbs. per square inch. They compare favorably in high resistance to atmospheric corrosion, and offer abrasion resistance equal to carbon steels of like physical properties.

Certain differences in chemistry and in fabricating qualities do exist, however, between these steels. For that reason, Republic, in accordance with its practice of providing industry with a broad range of steels and steel products, makes all three materials.

During the past ten years, COR-TEN and REPUBLIC DOUBLE STRENGTH have proved their ability to reduce dead-weight and increase capacity without sacrifice in safety, maintenance costs or service life of equipment. Although it is the newest member of this high strength trio, ALDECOR's ready forming and welding characteristics indicate that it may be favored for certain types of applications.

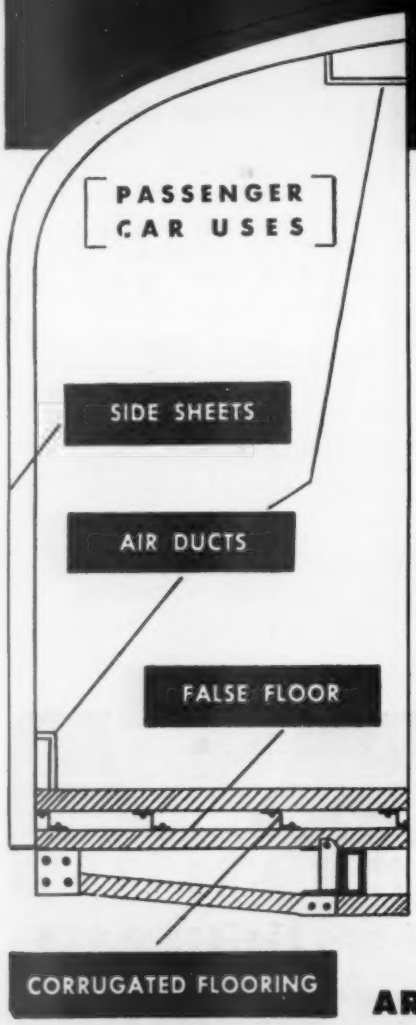
Republic metallurgists are ready NOW to work with you in selecting the material best suited to meet your own particular requirements. Write directly to:

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic
HIGH STRENGTH STEELS
ALDECOR • COR-TEN • DOUBLE STRENGTH

Other Republic Products include Carbon, Alloy and Stainless Steels — Sheets — Plates — Pipe — Spiral Rivets — Electric Resistance Welded Tubing

THESE VITAL PARTS LAST LONGER WHEN YOU GET "*Triple Protection*"



There's a ready answer to costly rust-problems for the new car roofing, flooring, siding and ductwork jobs in your shops.

It is ARMCO ZINCGRIP with the Bonderized PAINTGRIP surface treatment — the special sheet steel that assures *triple protection* for car parts constantly exposed to corrosive attack.

WHAT IS THIS TRIPLE PROTECTION?

First, a special full-weight zinc coating that clings to the steel *even in severe forming and drawing* operations. Second, the Armco mill-Bonderized treatment; third, the paint finish that adheres to the PAINTGRIP surface much longer than paint on ordinary galvanized or sand-blasted steel. There is no direct contact of paint with zinc. The neutral Bonderized surface helps preserve the oils that keep paint soft and flexible—prevents early peeling and flaking.

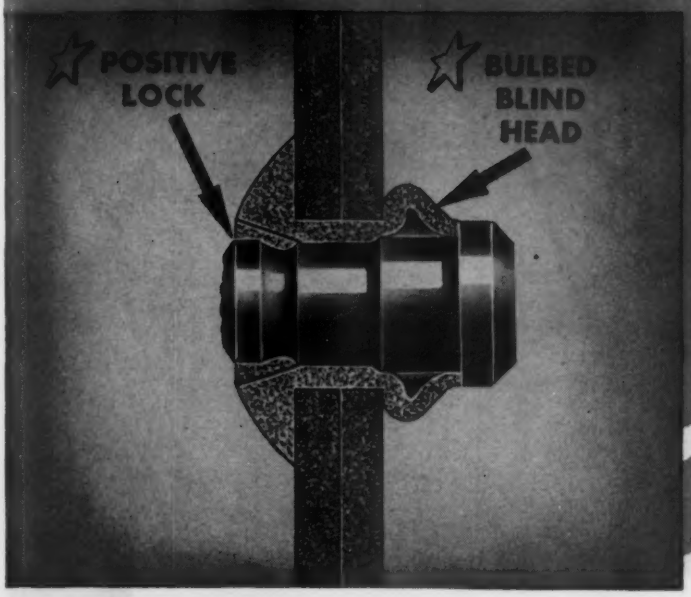
Bonderizing makes the surface ready for *immediate painting*. No acid etching or other pre-treatments are needed. Paint goes on easily and smoothly.

You have a choice of three base metals: low-alloy high strength steels, open hearth or copper steels. Write for the free PAINTGRIP booklet. Just address the Armco Railroad Sales Co. Incorporated, 2581 Curtis Street, Middletown, Ohio.

ZINCGRIP-PAINTGRIP ARMCO STEEL

ARMCO RAILROAD SALES CO. INCORPORATED

Two Big Reasons



WHY HUCK BLIND RIVETS ARE EXCEPTIONALLY STRONG...SAFE... DEPENDABLE

POSITIVE LOCK
Gives Unusual Strength; Holds Pin Securely in Sleeve

DURING the driving operation, after the blind head has been formed, a locking collar at the outer end of the rivet sleeve is automatically forced into the conical space formed by recess in head of sleeve and locking groove in pin. This rigidly and permanently locks the pin to the sleeve, so that the driven Huck Blind Rivet is substantially the mechanical equivalent of a one-piece ***solid*** rivet.

In many cases the thickness of the sheets is such that the bearing value is insufficient to develop the full shear strength of the rivet. Under such conditions the great increase in rivet tensile strength resulting from the lock avoids joints loaded in single shear becoming critical and failing in rivet tension.

Comparative tests of identical Huck Blind Rivets with the lock both driven and undriven show that this positive lock increases the ultimate strength of a joint loaded in single shear from 10.3% in the case of thick sheets (joint considered critical in rivet shear), to as much as 63.3% in thin sheets (joints considered critical in sheet bearing).

In addition, this positive lock definitely prevents the pin from working loose under any conditions of vibration or fatigue loading—regardless of whether the rivet has been driven in a properly-sized or oversize hole.

BULBED BLIND HEAD
Provides Tight Grip, with Stronger, More Rigid Joint

BECAUSE of special graduated work-hardening during manufacture, the end of the rivet sleeve upsets to form a ***bulbed*** head rather than flaring out into a tulip head. This eliminates any possibility of splitting the blind head.

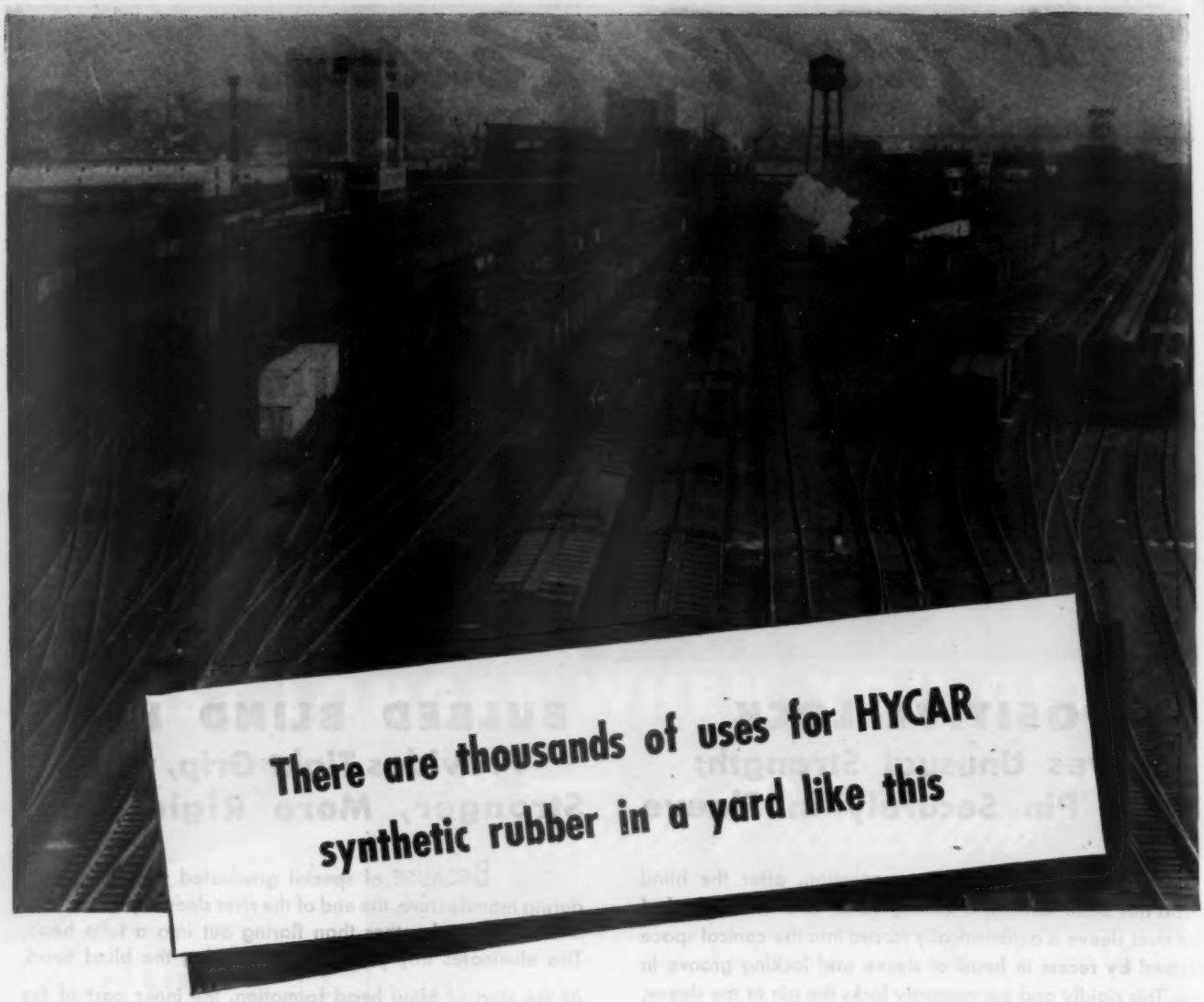
At the start of blind head formation, the inner part of the bulb tries to form within the hole. As the bulb folds toward the sheet, the resulting leverage action clamps the sheets together very tightly.

Flattening of the bulb against the sheet provides an ample area of contact between blind head and sheet, assuring great strength and rigidity.

● ***Illustrated manual (Bulletin 451) gives full details of these and other exclusive features, together with complete working data. Write for your free copy today.***

Huck MANUFACTURING CO.

2480 BELLEVUE AVENUE **DETROIT 7, MICHIGAN**



There are thousands of uses for HYCAR synthetic rubber in a yard like this

MANY rubber parts—hose of all kinds, gaskets and seals, vibration dampeners, mountings and bushings, cable sheathing, and many others—are wearing out too fast in American railroad yards, running up maintenance time and wasting money, because the *wrong kind* of rubber is being used.

Wherever a resilient rubber part is exposed to oil or grease, extreme temperatures, severe abrasion and wear, sunlight, and other destructive factors—that part should be made from HYCAR synthetic rubber.

HYCAR's important inherent properties are shown in the list at the right. These properties can be selected in any combination to meet the known service conditions of a rubber part. That's why we say that parts made from Hycar can save you money by lasting longer and reducing maintenance expense.

We make no finished rubber parts from HYCAR. We supply the crude rubber as raw material to companies who make it into finished rubber products. So ask your supplier for parts made from HYCAR for test in your own applications—severe or routine. Learn for yourself that it's wise to use HYCAR for dependable, long-time performance. For help with product development or for information on procurement of HYCAR parts write *Hycar Chemical Company, Akron 8, Ohio.*

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. *EXTREME OIL RESISTANCE—insuring dimensional stability of parts.*
2. *HIGH TEMPERATURE RESISTANCE—up to 250° F. dry heat; up to 300° F. hot oil.*
3. *ABRASION RESISTANCE—50% greater than natural rubber.*
4. *MINIMUM COLD FLOW—even at elevated temperatures.*
5. *LOW TEMPERATURE FLEXIBILITY—down to —65° F.*
6. *LIGHT WEIGHT—15% to 25% lighter than many other synthetic rubbers.*
7. *AGE RESISTANCE—exceptionally resistant to checking or cracking from oxidation.*
8. *HARDNESS RANGE—compounds can be varied from extremely soft to bone hard.*
9. *NON-ADHERENT TO METAL—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)*

Hycar

Reg. U. S. Pat. Off.

LARGEST PRIVATE PRODUCER OF BUTADIENE TYPE

Synthetic Rubbers

American Hammered Bronze Iron Sectional Cylinder Packing

Helps Set New Highs in Availability— New Lows in Repairs

Norfolk and Western Class J locomotives were developed to make long runs with minimum servicing and repairs . . . to haul heavy tonnage passenger trains at high speeds over heavy mountain grades . . . and to do the job at lowest possible cost.

This program of course demanded top durability and dependability from all equipment. For the highly important main cylinder packing, the designers chose American Hammered Bronze-Iron Segmental packing. Compared to Type "K's" over a 36-month period the locomotives have made remarkable records. They spent 48% less time in shop, made over 75% more total mileage and 63% greater daily mileage, and cut repair costs per locomotive mile over 26%.

The Bronze rings in this packing make an effective seal immediately, smooth and condition the cylinder wall while the iron rings are brought to a final seat. When you want to increase locomotive availability, remember we have Rings in Every Size . . . of Every Type . . . for Every Purpose.

KOPPERS COMPANY, INC.

American Hammered Piston Ring Division

BALTIMORE 3, MARYLAND

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

FOR TOMORROW: Count on those who are doing the tough job today

POINTED RHYMES FOR TRYING TIMES

by
Berton Braley

Here is wisdom by the peck
Versified to save your neck!

DON'T BLOW IT

Oh, workman or scholar,
Hang on to your dollar
And do not spend it soon,
For every cent
Unwisely spent
Inflates the price balloon.

IT MAKES SCENTS

To market (black market) to spend lots of jack
Careless of how many ceilings you crack,
To market (black market) where prices are dear,
—Gosh, there's a terrible smell around here.

If

If you can keep your head and calmly ponder
How silly spending drives the prices high;
If you can save the cash you'd like to squander
And only buy the things you need to buy;
If you can do your part to fight inflation
By simply being thrifty with your pelf,
You'll do a vital service to the nation
And—furthermore—you'll benefit yourself.

Bonds you buy with payroll earnings,
Help fulfill your future yearnings.

NO GAMBLE

When the war is over, will the prices
rise or fall?
We do not know the answer, and
nobody does, at all.
But this much we *can* prophesy—
whichever way they go:
You will find it more convenient if
you've saved a little dough.

★ ★ ★

Money in your pocket,
Take it out and sock it
Into War Bonds, which
Help to make you rich.

DOUBLE AND NO QUITS

When you boost your paycheck quota and allot it
To another bond—it's pretty soft for you!
For, although you've spent your money—you
have got it,
And the Interest is interesting too.

WHO? ME?

There was a little dope with a fat
pay envelope
And she spent every cent that
was in it.
And she wondered, by-and-by,
why the prices rose so high,
But she didn't blame herself for
a minute.

★ ★ ★

INFLATIONARY MARY

Inflationary Mary spills
This silly kind of chatter:
"My little teeny-wee bills
And spendings do not matter.

"And if I cheat a little bit
On rationing and ceilings
The Nation's welfare isn't hit
By my small lawless dealings!"

Inflationary Mary's wrong.
For she'd be much to blame
If people in a mighty throng
Should say and do the same.

Small spendings, in the aggregate,
Reach sums extraordinary,
So let's not try to imitate
Inflationary Mary.

★ ★ ★

ADVERTISERS, PUBLISHERS—NOTE:

You are welcome to use all or any part of the material on this page to aid the fight against inflation.

SNAKE IN THE GAS

There was a crooked man and he
lived in crooked style,
He dealt at crooked markets with a
smugly crooked smile.
He viewed himself as clever with
his crooked ration book,
But everybody knew him for a
crooked little crook.

★ ★ ★

THE GANG'S ALL HERE

You may ask, "Why should *my* spending
Cause inflationary trending
Though I squander every penny I have got?"
—If you're joined by sixty millions
Of civilians blowing billions,
You'll discover that it matters quite a lot!

YOU CAN LAY TO THAT

As the best egg for a nest-egg
Buy a War Bond—buy a batch.
But you gotta keep 'em settin'
Or they ain'ta gonta hatch!

Save your pay
Here's a way—
Bonds and savings and insurance
Give your future more endurance.
Mrs., Mister,
Brother, Sister,
Don't compete in buying things
That is whence inflation springs.

ONE PERSON CAN START IT!

You give inflation a boost

—when you buy anything you can do without
—when you buy above ceiling or without
giving up stamps (Black Market!)
—when you ask more money for your services
or the goods you sell.

SAVE YOUR MONEY. Buy and hold all the War Bonds you can afford—to pay for the war and protect your own future. Keep up your insurance.

A United States War message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by this magazine in cooperation with the Magazine Publishers of America.

Smoothing and Improving the Ride

IN PEACE & WAR • ON HIGHWAY & RAILWAY • ON BATTLEFIELD & FARM

MONROE DIRECT-DOUBLE-ACTION *HYDRAULIC* SHOCK ABSORBERS

In every line of endeavor there is always one "best," one product that sets the standard of quality, one organization recognized as the source of innovations, of most advanced design, of finest construction. In the field of Hydraulic Shock Absorbers for smoothing and improving the ride in motor vehicles and railway cars, that leader is Monroe. Monroe Direct-Double-Action *Hydraulic* Shock Absorbers have been standard on leading American cars, trucks and railway passenger cars. In the war they proved their superiority on motorized vehicles from Jeeps to great tanks. Today, the experiences gained in this hard, critical service is reflected in even finer Monroe Products.

ARMY E NAVY

Patents Make Jobs

MONROE

MONROE AUTO EQUIPMENT CO., MONROE, MICH.

2473

LIGHTING AND AIR CONDITIONING EQUIPMENT FOR RAILWAY SERVICE

THE SAFETY CAR HEATING AND LIGHTING COMPANY, INC.

NEW YORK • CHICAGO • PHILADELPHIA • BOSTON

ST. LOUIS • SAN FRANCISCO • MONTREAL

DC

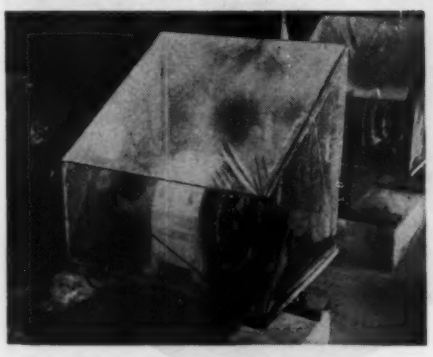
DOW CORNING

SILICONES

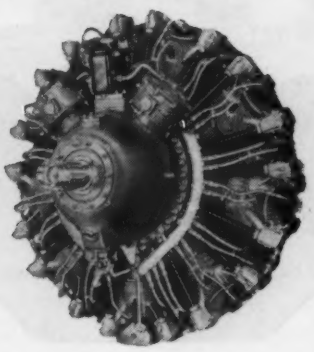
Exclude Water

. . . even after aging at elevated temperatures

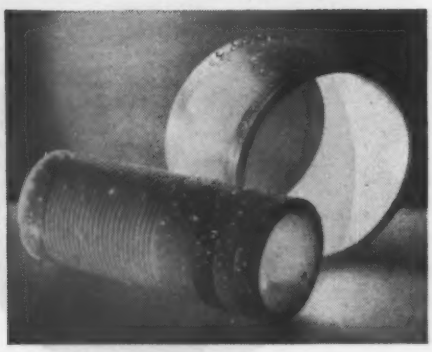
Water repellency is one of the basic properties of Dow Corning Silicone products. Exceptional stability over a wide temperature range is another. These two properties recommend Dow Corning Silicones for the solution of many hitherto insolvable industrial problems involving the exclusion of moisture at elevated temperatures.



DC VARNISHES and RESINS have made possible Silicone Insulation, a new class of electrical insulation which excludes moisture from equipment operating in wet or hot locations despite normal operating temperatures of 175° C.



DC COMPOUNDS are heat stable materials easily applied to form a waterproof dielectric seal for disconnect junctions in ignition systems, radio and radar equipment. Non-melting, low freezing properties keep compound where it belongs.



DC FLUIDS, colorless, odorless, inert liquids, form a durable water repellent film over glass and ceramic surfaces to enable insulator bodies to retain their originally high surface resistivity even after immersion in salt water.

DC Silicone Varnishes, Fluids, Greases, Compounds and Rubber (Silastic*) are in commercial production and in general distribution. Inquiries are invited concerning your particular problems involving moisture exclusion, high temperature insulation and special lubrication.

*TRADE MARK, DOW CORNING CORPORATION

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

New York Office: Empire State Building

Dow Corning

FIRST IN SILICONES

Barber Stabilized Trucks

Assure *Smooth Riding* Freight Cars

The Friction pressure developed with Barber Stabilized Trucks to control the vertical harmonic action of springs is in proportion to the car load — NOT A FIXED PRESSURE.

Selected for over 95,000 cars by 55 Railroads and Private Car Lines

STANDARD CAR TRUCK COMPANY

332 SOUTH MICHIGAN AVENUE CHICAGO 4, ILLINOIS

KOPPERS PRESSURE-TREATED WOOD can help keep your Ballast Cars on the job —longer

Ballast cars must take a terrific beating in service, and in the past a lot of maintenance men accepted frequent repairs as a necessary evil.

In many cases, however, breakage that was chalked up as *mechanical* failure *was actually induced by decay.* Koppers Pressure-Creosoted wood is protected against decay . . . and so helps cut down shoppings, as a number of roads are already proving to their satisfaction and profit.

A railroader recently predicted, "The next five years will witness the greatest transformation in the tools and methods of the railway business that we have ever had in anything like that period of time. This transformation will be mainly in the direction of modernization . . . to build in added quality and dependability all the way up, including . . . cars."

You'll find one of the best opportunities for car modernization in the use of pressure-treated wood.

It helps to reduce the percentage of bad-order cars, and actually costs far less per year than untreated material.

We will be glad to give you details and suggested specifications.

KOPPERS COMPANY, INC.—WOOD PRESERVING DIVISION

PITTSBURGH 19, PA.

KOPPERS

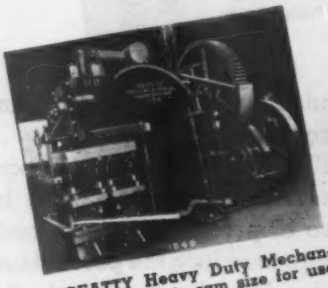
Buy War Bonds—
and Keep Them!

THE INDUSTRY THAT SERVES ALL INDUSTRY

BEATTY

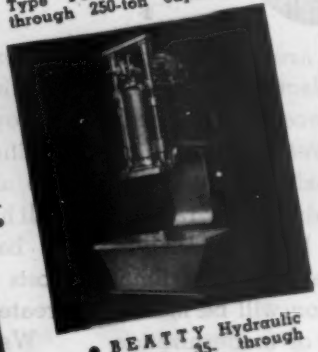
BUILDS A COMPLETE LINE OF HEAVY R. R. SHOP EQUIPMENT

• The BEATTY Press Brake & Flanging Machine handles V-Bending, Forming, Pressing, Flanging, and Straightening. A time-saving, money-saving unit. Write for Bulletin 300.

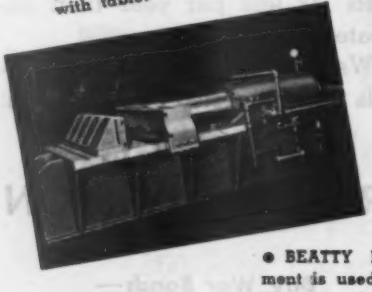


• BEATTY Heavy Duty Mechanical Punch; Note ram size for use with table.

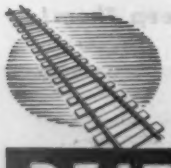
• BEATTY Hydraulic Gap Type Forming Press. 50- through 250-ton capacities.



• BEATTY Hydraulic Bulldozer. 35- through 200-ton capacities.



• BEATTY heavy metal working equipment is used in all leading railroad shops. Write for full details on heavy hydraulic and mechanical punches, shears, coping machines, forcing presses, extruding presses, hydraulic forming presses, bulldozers and spacing tables.



BEATTY MACHINE & MFG. CO.
HAMMOND, INDIANA

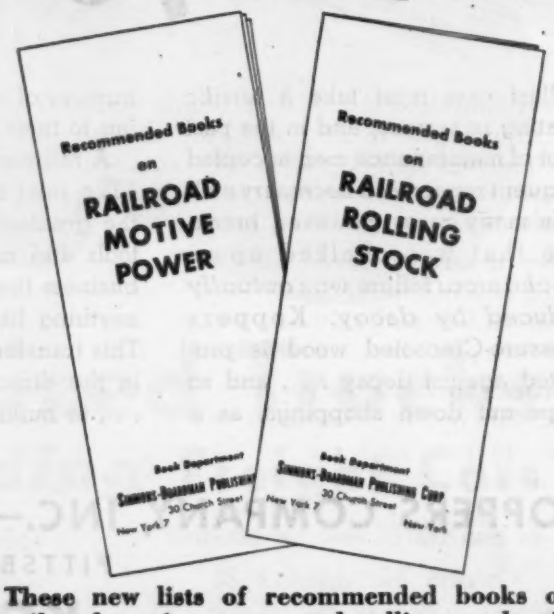
GET TOGETHER DEPARTMENT

FOR SALE

SPECIAL OFFERING
85
50-Ton All Steel Side Discharge Hopper Cars.
1831 cu. ft. Capacity.
Cast Steel Side Frames.
Prompt Delivery
IRON & STEEL PRODUCTS, INC.
40 years' experience
13470 S. Brainard Ave., Chicago 33, Ill.
"ANYTHING containing IRON or STEEL"
ISP'S popular Scripto pencil sent to all responders

BUY VICTORY BONDS

FREE ON REQUEST



These new lists of recommended books on railroad motive power and rolling stock will be mailed free on request. They are 3½ x 8-inches in size and describe 125 technical books.

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CAN YOU USE A 50% Saving IN FASTENING TIME ON CAR REPAIR WORK?

U. S. RAIL TRAFFIC HEAVIEST IN HISTORY
Shortages of man-power and rolling stock pose tremendous problems
Congestion of U. S. railroads, resulting from the heaviest traffic schedules ever handled in their history, will necessitate drastic curtailment of passenger service. It will require the use of every bit of roll-

Every shop today needs the man-hours that can be saved by trimming 30 to 50% off fastening time and labor. Such savings are being made every day, in many of the biggest car repair shops, by the use of P-K Self-tapping Screws wherever possible.

DON'T LET NEEDLESS TAPPING, slow bolt assemblies, or awkward riveting tie up badly needed workers. Use the short-cut fastening method – with P-K Screws – and get the "cripples" back carrying pay loads days faster.

AMERICA'S FOREMOST CAR BUILDERS know the advantages of P-K Self-tapping Screws – use millions in new construction – to speed work and lower costs, and to make sure of dependable strength. P-K Screws form their own tight-fitting threads, as they are driven . . . won't work loose even under constant vibration.

CALL IN A P-K ASSEMBLY ENGINEER. He'll help you find all the opportunities for savings – and help you choose the right P-K Screw for any fastening . . . in light or heavy steel, cast iron, aluminum, brass, plastics. If you prefer, mail assembly details for recommendations. Parker-Kalon Corp., 208 Varick Street, New York 14, N. Y.

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Quality-Controlled
SELF-TAPPING SCREWS

For Every Metal or Plastic Assembly

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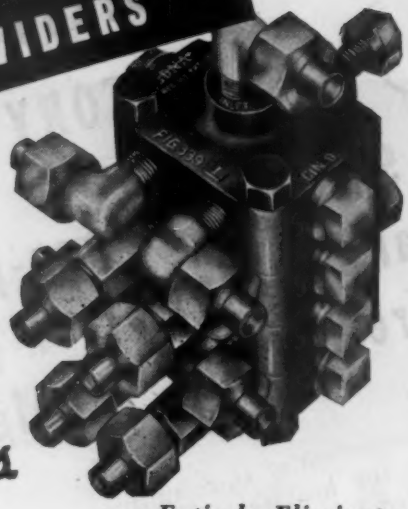
"POSITIVE" OIL FEED DIVIDERS



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Available in unlimited number of practical combinations to divide and deliver lubricants to any points and in any quantities.

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Progressive Feed

the only correct metal-cutting principle

comparison proves

1. Proper Design — Based on nearly forty years experience in the art of metal cutting.
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RACINE "Variable Volume" Oil Pumps
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RACINE Oil Hydraulic Pumps in three capacities: 12, 20 and 30 G.P.M. provide from zero to full capacity without relief valves. They operate at pressures from 50 to 1000 lbs. P.S.I. Ask for catalog P-10-C.

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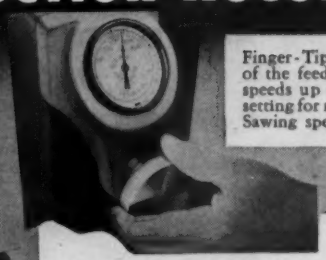
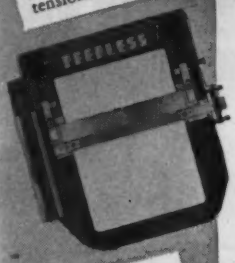
PEERLESS Features *That Boost* Production Records



Finger-Tip Control of the feed pressure speeds up accurate setting for maximum Sawing speeds.

Four-Sided Saw-Frame permits high blade tension.



Conveyor with automatic Micro-set Length Gauge can be added right on the job.

PEERLESS has exclusive features that help you make better production records on metal Sawing . . . Four-Sided Saw-Frame with Blade-Backing-Plate . . . Finger-Tip Feed Pressure Control . . . and Micro-set Length Gauge.

These are the principal features that give smooth, vibrationless Sawing at high speeds . . . top quality at lower cost! All your tough metal Sawing operations are greatly simplified when the work is planned for a Peerless Hydra-Cut. Find out today how these precision cutting tools—with all their exclusive features — can make better production records in your shop. See your local Peerless dealer or write direct for complete information.

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14" Hydra-Cut Saw in Consolidated Vultee Plant.

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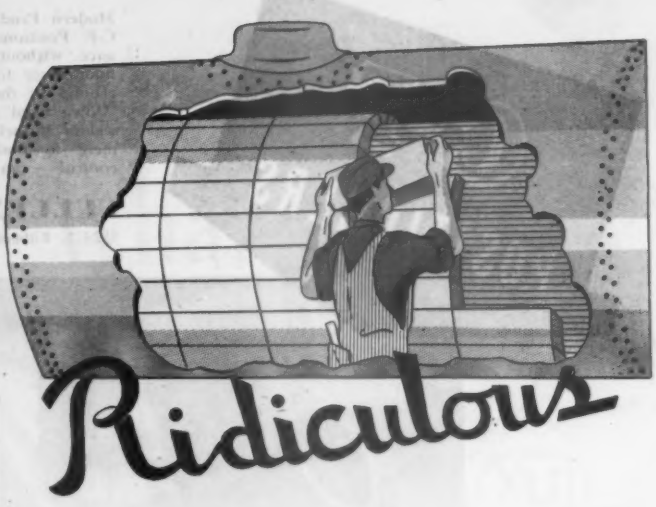

Ridiculous

CERTAINLY it's ridiculous to lag the heating surface of boiler flues and tubes.

No one would do it intentionally, but raw or improperly treated feedwater does it every day in the form of scale deposits and sludge. Heat transfer is retarded, fuel costs increased and boiler efficiency lowered.

RC Water Conditioner corrects and prevents these unintentional losses simply and economically. There is nothing to add—No preboiling is required.

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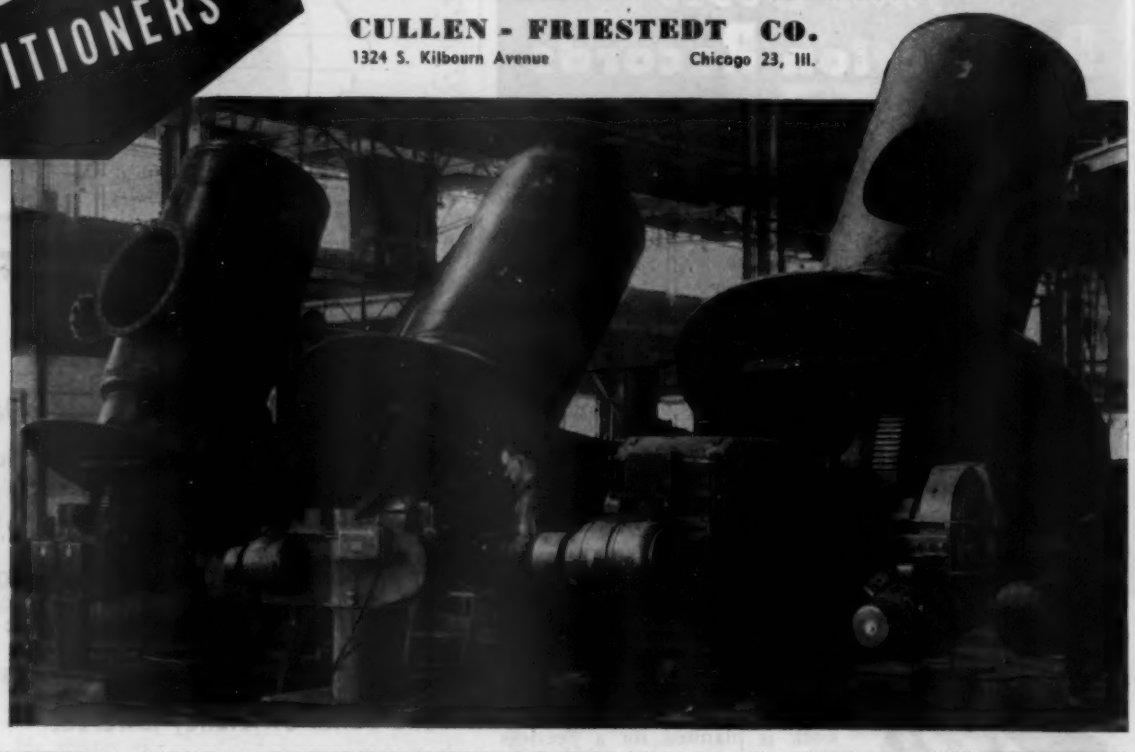
C-F Positioners come in capacities for all weldments — from small hand operated positioners to giant units that easily handle great weldments weighing up to 30,000 lbs. (1 No. 140, C-F Positioner, Capacity 14000 lbs. and 2 No. 60, 6000 lb. capacity illustrated).

CULLEN - FRIESTEDT CO.

1324 S. Kilbourn Avenue Chicago 23, Ill.



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UNIVERSAL BORING MACHINE FEATURES INSURE PRODUCTIVE CAPACITY AND ACCURACY

1. Three Bed Ways — span 44 inches.
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6. Heavy duty type — heaviest 4" spindle machine built.
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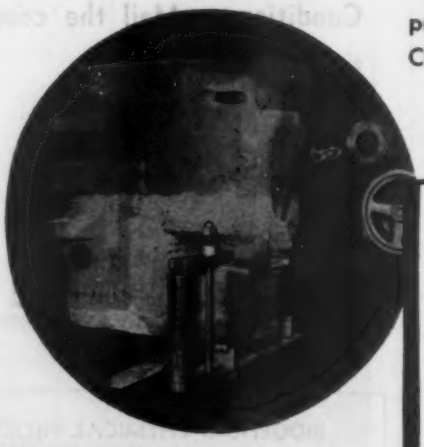


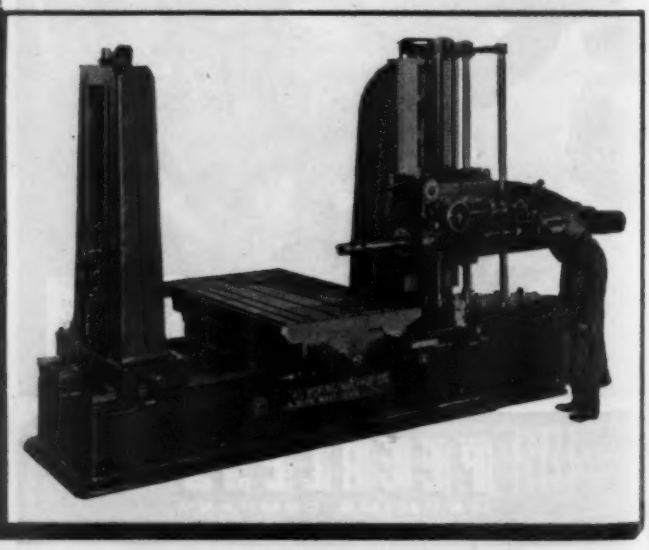
Railway construction and maintenance shops will find the UNIVERSAL BORING MACHINE a welcome addition, because of its versatility in precision machining operations.

This improved UNIVERSAL BORING MACHINE is available in 4" and 5" spindle sizes. Both are readily adaptable to do many boring, milling, turning, facing, recessing, and threading operations.

And UNIVERSAL can also show you how to handle many more precision jobs on a UNIVERSAL HORIZONTAL BORING MACHINE with the Tri-Way bed.

Write today for complete information.

◀ Milling Diesel Engine Frame for Switching Locomotive.



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HUDSON, MASS., U. S. A.

LUFKIN MICROMETERS FOR SURE, EASY MEASURING

Lufkin micrometers make quick, easy work of miking hard-to-get-at surfaces. Tapered frame slips in where clearances are small, eliminating the need for gauge blocks, parallels, and other awkward miking methods. Less chance for error in reading, since each thousandth graduation on the spindle is plainly numbered. In Lufkin mikes you get easy-to-read accuracy combined with quality and superior workmanship. Get the best —specify Lufkin on your requisitions. Write for free catalog. THE LUFKIN RULE CO., SAGINAW, MICH., New York City.

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Railroad Men Know...

What a Big Part *a small part can play!*

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EX-CELL-O for PRECISION

To right: Some Ex-Cell-O Hardened and Ground Steel Railroad Bushings and Pins.

The use of Ex-Cell-O Pins and Bushings does not interrupt train schedules through failures in service. They wear slowly, and the little wear that does occur (after hundreds of thousands of miles of service) is evenly distributed over all surfaces of the pins and bushings. The net result is lower maintenance costs . . . Ex-Cell-O Pins and Bushings can be depended upon to last for several shoppings without replacement.

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EX-CELL-O CORPORATION

Detroit 6, Michigan

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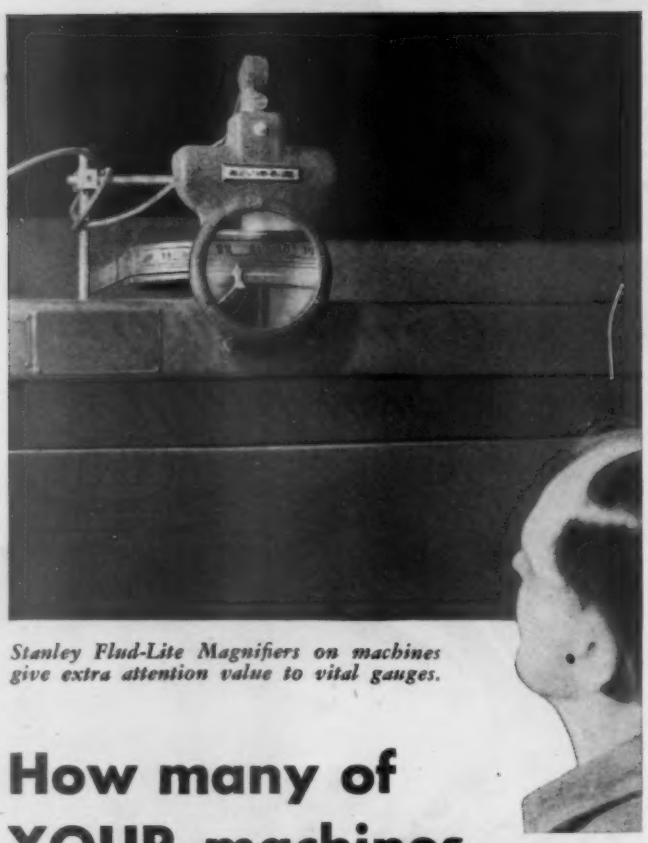

Stanley Flud-Lite Magnifiers on machines give extra attention value to vital gauges.

How many of YOUR machines have BLIND SPOTS?

Turn a Stanley "Flud-Lite" Magnifier on that gauge, indicator, level or observation window and watch that blind spot disappear! With the "Flud-Lite" Magnifier you get magnification through a high quality 5" lens *plus* shadow-free fluorescent light – a combination that provides instant readability and eliminates eyestrain. Used on machines, on the inspection bench, or for assembly of small parts, Stanley "Flud-Lite" Magnifiers help increase production by supplying better visibility on the job. Write today for illustrated folder. Stanley Electric Tools, New Britain, Connecticut.

STANLEY

No. 701. *Bench type Stanley Flud-Lite Magnifier. Steel base is removable to permit attachment of Magnifier to machine or fixture.* **No. 701H.** *Portable type Stanley Flud-Lite Magnifier.* **No. 05.** *Stanley Auxiliary Lens, a powerful 2½" lens, which added to the Stanley Flud-Lite Magnifier, doubles its power.*

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Matched Performance of brushes MAKES MOTORS BEHAVE

SPEER

To get the most work out of d.c. and slip-ring motors and generators, equip them with SPEER Carbon Brushes. They make motors BEHAVE, because every SPEER brush is *matched*—mechanically and electrically—to the service characteristics of the machine it's sold to serve.

More and more motor users are turning to SPEER brushes for utmost freedom from burning, overheating, sparking, excessive wear, energy losses, and other brush troubles that decrease operating efficiency, cause extra maintenance.

You have *double* assurance of matched performance from SPEER brushes. First, because SPEER has made a specialty of matching brushes to machines for nearly 50 years. And second, because in SPEER'S all-inclusive line of standard and special carbon, graphite, electro-graphite and metal-graphite brushes, there is the grade that will deliver peak performance, fewer brush renewals and less maintenance on any application.

For SPEER brushes matched to the performance of *your* motors, see your supply house or electrical contractor — or write direct for Brush Data Forms.

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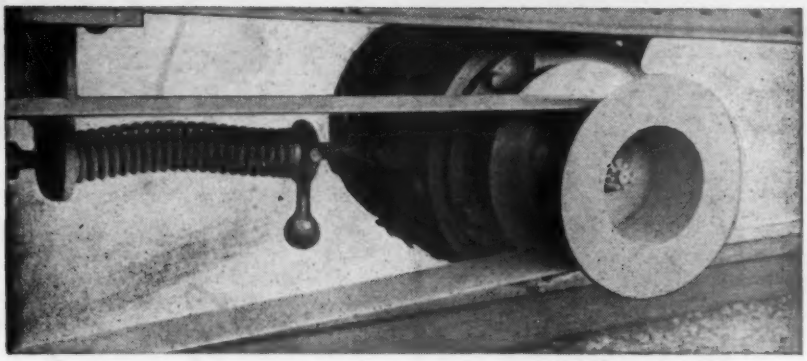
VEELOS *Balata* BELTING



- Minimum Stretch
- High Tensile Strength
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MANHEIM MFG. & BELTING CO.

NEW YORK OFFICE
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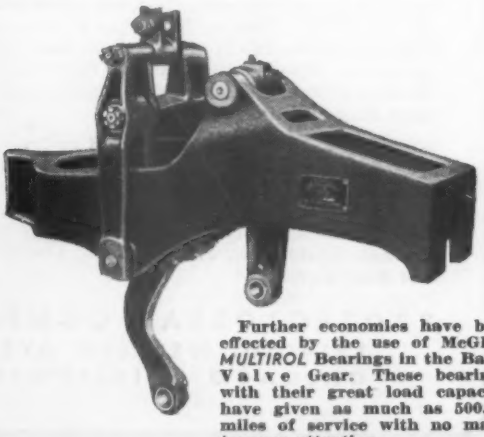
MOVING *Heavier Freight* AT FASTER SPEEDS

These critical war days, of heavier freight and faster speeds, call for equipment of greater efficiency. The new Baker Long Lap Locomotive Valve Gear delivers an increase in power with a decrease in steam consumption. This gear, with a travel of 9", makes possible a marked improvement in starting, and in the maintaining of higher speeds.

The Baker Valve Gear also comes in the Standard model, for travels up to 7½", and the Long Lap model, for travels from 7½" to 9". Baker Valve Gears are adaptable to all types of locomotives.



Further economies have been effected by the use of McGILL *MULTIROL* Bearings in the Baker Valve Gear. These bearings, with their great load capacity, have given as much as 500,000 miles of service with no maintenance attention.

Write for descriptive literature, and list of present users.

THE PILLIOD COMPANY

Factory—Swanton, Ohio

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EFFICIENCY
SAFETY
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in handling
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SHOWING FIRE BAFFLE

SAFETY CANS

REDUCE WASTE. Protectoseal Safety Cans eliminate spillage and waste common in handling fluids because the spout and cap are designed for easy, accurate pouring. The spring-closed cap is operated by the carrying hand for quick starting and dripless cut-off. The large spout is also the fill opening.

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STOP LOSS. Evaporation losses of volatile fluids, common in ordinary containers, are prevented in Protectoseal Safety Cans by the gasketed spring-held cap. Pressure on this cap is at the center, insuring a leak-proof seat. Heavy construction and reinforcing bottom shock ring prevent breakage of can and loss of contents from rough handling.

APPROVED. Protectoseal Safety Cans, made in 7 sizes from 1-qt. to 10-gal. capacity, are approved by Underwriters Laboratories and Associated Factory Mutuals. *Write today for complete data on the PROTECTOSEAL line of Fire Baffle Fill and Vent Fittings, Safety Cans, Plunger Cans, Thawing Cans, and Wash Tanks.*

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FOR 101 METAL CUTTING JOBS

WELLS No. 8

Handy as a

WITH A WELLS No. 8 you can efficiently cut any size, shape or type metal you can fit into the saw. The work is simply clamped into the quick-acting vise and cutting begins. No more attention is required, for the gravity-feed and the automatic shut-off do the rest. Use your Wells for all types of cut-off work—in stores, tool rooms, maintenance. Move your portable Wells to the work and save time and labor. A simple wet cutting system is available for all Wells No. 8 models to allow coolant use on tough cutting jobs. It's a handy tool . . . this low-cost, versatile Wells No. 8. Write for details.

Specifications

CAPACITY: Rectangular . . . . . 8" x 16"
(Special Guides) . . . . . 5" x 24"
ROUNDS: . . . . . 8" Diameter
MOTOR: . . . . . ½ H. P., A. C. or D. C.
SPEEDS: . Selective 60, 90, 130 feet per minute
WEIGHT: . . . Approximately 750 pounds

Wells SAWS
Wells

Products by Wells are Practical

METAL CUTTING BAND SAWS

WELLS MANUFACTURING CORPORATION
1616 POLK STREET, THREE RIVERS, MICHIGAN

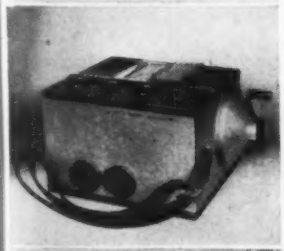
WHICH "MEGGER" INSULATION TESTER is best for you?

The "Megger"* line of instruments for testing electrical insulation is complete for ranges from a fraction of an ohm to 10,000 megohms, between which limits practically every insulation resistance measuring requirement falls. There are specific instruments for specific requirements and other types for more general use. Some users find one instrument suitable for all work, while others have use for several types.

If you are uncertain which type and range of "Megger" instrument is best for your particular needs, write us, telling the type, size and rating of your equipment. We will gladly make recommendations. Write also for *Pocket Manual of "Megger" Practice*, No. 1420-X.

The New U.S.-Made Midget "Megger" Tester. *In many ways, the most remarkable "Megger" instrument ever built. Weighs only 3 lbs.—will fit an overcoat pocket or tool kit. Reads up to 50 megohms. Generates 500 volts and is always ready for use anywhere because of the hand crank. Bulletin 1785-X.*

The U.S.-Made "Megger" Insulation Tester. *Contains the usual "Megger" direct-reading true ohmmeter, of the permanent magnet moving coil type, mounted with a d-c hand generator in a plastic molded case. Ranges up to 2000 megohms, with hand generators up to 1000 volts. Widely used in hard service. Variable-pressure ("Meg") and constant-pressure ("Super-Meg") types. Bulletin 1735-X.*



The "Bridge-Meg" Resistance Tester. *This instrument is a combined "Megger" Insulation Tester and a four-dial multiratio Wheatstone Bridge. Will measure any ohmic resistance from .01 ohm up to 100 or 200 megohms; hand generators rated up to 1000 volts. A complete and compact unit that is ideal for power companies and industrial plants. Catalog 1685-X.*

High-Range "Megger" Testing Set. *The original heavy-duty type "Megger" Testing Instrument. Made in all ratings up to 10,000 megohms and 2500 volts. A combination high-potential testing and insulation resistance measuring set. Hand- and motor-driven types. Catalog 1685-X.*

**Trade Mark Reg. U. S. Pat. Off.*

JAMES G. BIDDLE CO.
1211-13 ARCH STREET, PHILADELPHIA 7, PA.

Okadee

TYPE FCA
AIR OPERATED

BLOW-OFF VALVE

The Okadee Air Operated Blow-Off Valve is constructed for air operation and it can be operated manually by means of the stub-end lever when there is no air pressure. This valve is made with a flanged cast steel body, a forged stainless steel stem and renewable alloy seat. It fits closely to the side of the boiler, measuring 7⅛″ over the widest portion.

Type N Operating Valve

The Type N Operating Valve, as illustrated, is regularly furnished with the Air Operated Blow-Off Valve. This Operating Valve is provided with important safety features. First—the safety latch for locking the handle in SHUT position is such that the valve cannot be opened accidentally. Second—all ports are connected with the exhaust passageway when the handle is in SHUT position.

Write for our new OKADEE Blow-Off Equipment Bulletin 431.

THE OKADEE COMPANY
332 SOUTH MICHIGAN AVENUE, CHICAGO

PREVENT COSTLY DELAYS AND POSSIBLE DAMAGE TO ENGINES
WITH AMERICA'S MOST WIDELY USED DIESEL NOZZLE TESTER

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NOZZLE TESTER

Keeps Diesel Engines Running Efficiently

To keep diesel engines operating at peak efficiency, this portable, precision-built Adeco Nozzle Tester is indispensable.

Light in weight yet built for heavy-duty service, it enables any mechanic to make quick accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Tests both large and small injectors, on bench or engine, at pressures up to 10,000 p. s. i. Prevents costly delays and possible damage to engine.

Ideal for testing hydraulic devices.

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Write for bulletin on this practical, low-cost unit.

TESTS FUEL INJECTORS AND HYDRAULIC DEVICES at Pressures up to 10,000 p.s.i.

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AIRCRAFT & DIESEL EQUIPMENT CORP.

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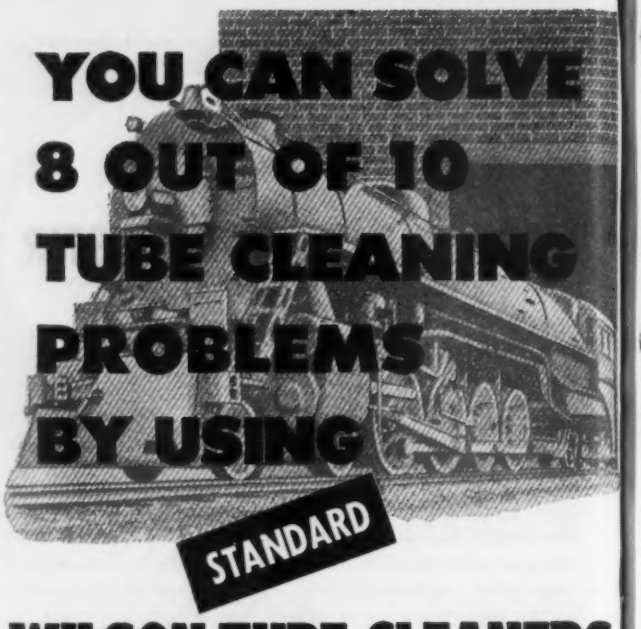

YOU CAN SOLVE 8 OUT OF 10 TUBE CLEANING PROBLEMS BY USING STANDARD

WILSON TUBE CLEANERS

Yes, you can solve almost all tube cleaning problems without resorting to expensive or unusual equipment —if you use standard Wilson Tube Cleaners!

A recent survey shows that 80% to 90% of thousands of tube cleaning problems presented to Wilson Engineers can be solved easily when the right combination of Standard Wilson equipment is used.

You can choose a motor, cutter head, flexible shaft or other accessory from the complete line of Wilson Tube Cleaners, and assemble a cleaner that will help you get your tubes *cleaner, faster* and save you money as well as time.

A copy of the Wilson Tube Cleaners Check List will show you how to choose the right equipment. It contains a handy Tube Cleaner Selection Guide to help you pick the right motor, cutter head and accessory for any fouled tube condition. In addition there is a list of hints on maintenance and operation that will go a long way towards making you job pleasanter and your tube cleaners last longer.

Be prepared for tube cleaning emergencies. Send for your free copy of bulletin 75 today.

MODERN TUBE CLEANERS FOR THE PROBLEMS OF TODAY

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PIPE AND TUBE CLEANERS

TW-6

THOMAS C. WILSON Inc.
21-11 44th AVENUE, LONG ISLAND CITY 1, NEW YORK

WHEN THE FOAM METER LIGHTS UP

THE BOILER BLOWS DOWN—AUTOMATICALLY

Modern equipment in the engine cab includes the Signal Foam Meter which automatically indicates foaming tendencies of boiler water. The device is but one unit of the Electromatic Foam-Collapsing Blowoff System, which assures positive protection against water carry-over. The System does this:

1. Mechanically prevents expanded water from reaching dry pipe.
2. Skims off all the light suspended matter and oil
3. Removes completely, the heavy sludge from the mud ring.
4. Settles water quickly. Removes collapsed foam by blowoff valve.
5. Automatically opens and closes blowoff valves in accordance with foaming tendencies of the boiler water.
6. Cuts blowoff losses by automatically blowing only when necessary. This results in saving of water and maintaining high boiler efficiency.
7. Prevents foaming even when boiler works at peak capacity.
8. Blows water only at safe levels.
9. Permits extended washout periods, as it is unnecessary to wash boiler or change water to prevent foaming.

ELECTRO-CHEMICAL ENGINEERING CORPORATION
Subsidiary of Dearborn Chemical Company
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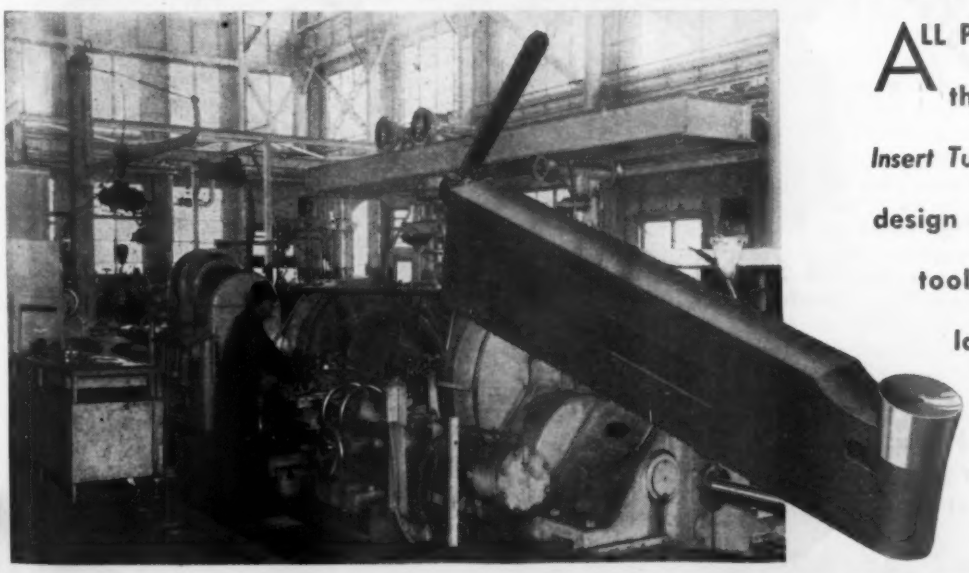
ALWAYS ON GUARD *Electromatic* FOAM-COLLAPSING BLOWOFF SYSTEM AGAINST WATER CARRY-OVER

GORHAM HEAVY DUTY TURNING TOOLS



ALL PERFORMANCE tests of the *Gorham Serrated Shank Insert Turning Tool* prove that this design not only reduces original tool costs but also assures large savings in set-up and machining costs of locomotive driving wheel and car wheel tires.

GORHAM TOOL COMPANY

14400 WOODROW WILSON AVENUE
DETROIT 3, MICHIGAN

SUPERIOR
3-WAY
FLUE ROLLER

One Tool
One Operation
FLARES
EXPANDS
PROSSERS

One tool — One operation and the job is done quickly and more efficiently with savings up to 80% in time and labor. A better and more uniform joint results in less down-time and longer service on the road.

Saves Time and Labor Up to 80%

Also Manufacturers of

Superior Automatic Soot Blowers
Superior Pneumatic Bell Ringers
Rees General Purpose Jacks
Heavy Duty Diesel Bearings

Let Us Send You Full Information

SUPERIOR RAILWAY PRODUCTS CORP.
7501 Thomas Boulevard, Pittsburgh, Penna.

Car Specialties by Motor Wheel

All Standard Type Spring Plates produced for your requirements.

Defect Card Holders made of heavy gauge, pressed steel construction.

Weatherproof. Large opening for convenient access.

The Above Equipment Fully Meets A.A.R. Requirements

T-Z RAILWAY EQUIPMENT CO., Inc.

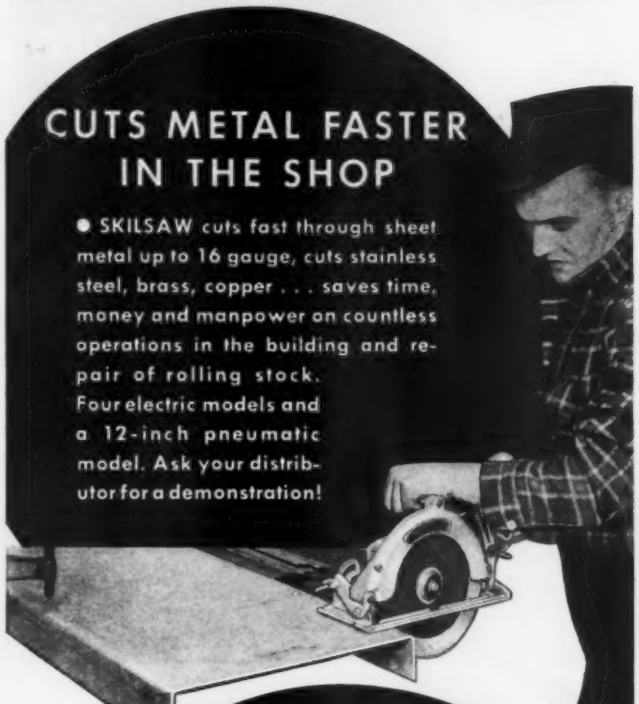
8 SO. MICHIGAN AVE., CHICAGO 3, ILL.

National Railway Sales Representative — ***Motor Wheel Corp., Lansing 3, Mich.***

SKILSAW
SPEEDS THE
BIG CUTTING JOBS!

CUTS METAL FASTER IN THE SHOP

● SKILSAW cuts fast through sheet metal up to 16 gauge, cuts stainless steel, brass, copper . . . saves time, money and manpower on countless operations in the building and repair of rolling stock. Four electric models and a 12-inch pneumatic model. Ask your distributor for a demonstration!



STEPS UP BUILDING AND MAINTENANCE

● SKILSAW speeds bridge and trestle construction . . . *saves hours* in building and repairing floors, roofs, doors and platforms. SKILSAW goes right to the job, makes every cut *quicker* and *easier*, even in lumber up to 4 inches thick. Call your distributor for a demonstration!

SKILSAW, INC.
5033-43 Elston Ave., Chicago 30, Ill.
Factory Branches in All Principal Cities

PORTABLE ELECTRIC
SKILTOOLS
MADE BY SKILSAW, INC.

THE MC-8 HEAVY-DUTY ROUSTABOUT CRANE

Fast, versatile load-handler that hustles stuff up to 10 tons all around your plant

● You have no load-handling emergencies when you have a Roustabout—whether it's a special car or a truck loading job, a heavy machine to be moved, any usual or unusual handling situation, Roustabout is where you want it when you want it—quick, powerful, low cost—saving time and manpower. Easily, smoothly, it lifts 2 tons at 27½ ft. radius, 10 tons at 9½ ft. Boom turntable and all gears run in oil; built for years of overwork. Hundreds of industries regard their Roustabouts as indispensable. Write today for complete story of these action-getting money-saving wheel or crawler cranes.

Roustabout saves you time and money on these and many other jobs

- Big stuff off and on trucks, freight cars
- Moving large machines and parts
- Handling bales, boxes, drums
- Moving big castings, motors, railroad and marine gear
- Loading air transport planes
- Handling tanks, pipe, structural steel rails, timber
- Installing heavy valves and fittings

ARMY E NAVY

THE HUGHES-KEENAN COMPANY
605 NEWMAN STREET • MANSFIELD, OHIO

ROUSTABOUT CRANE

Roustabout Cranes
By Hughes-Keenan
Load-Handling Specialists Since 1904

KEEP YOUR DIESELS OPERATING BETTER, LONGER AND AT LESS COST!

You probably bought Diesel equipment because it could deliver more flexible power, longer at less cost than other power.

To keep that equipment delivering top power longer, more economically and with a minimum of service cost — and especially with less time out for overhauls, — you need HALL Diesel Valve Servicing Equipment.

Write us today for complete information on the Model EDP Grinder shown above and the HALL Model 80A Valve Refacer — both designed expressly for servicing Diesels.

THE HALL MANUFACTURING CO.
TOLEDO 7, OHIO

HALL
DIESEL TYPE
VALVE SEAT GRINDER

ARMY (E) NAVY

5 Years' Production of MINES MOLDED RUBBER CABLE CONNECTORS for the Armed Forces

Enables Us To Better Serve You Now!

The tough usage of war has demonstrated the adaptability of Mines Molded Rubber Cable Connectors in Army and Navy use. Millions of these rugged connectors have been used all over the world — on Land and Sea.

Many types and sizes of Mines Connectors have been supplied in the war-time production drive for efficiency. Among them were Single Conductor and Multi-Conductor for all types of application — low amperage for electronic detectors and measuring instruments, naval shore installations and forces afloat, air force ground equipment and aircraft components, telephone and radio communication equipment.

Practically every branch of our fighting forces has been aided in its efficiency by Mines Connectors.

In recognition of a job well done, the men and women of the Mines Equipment Company have *four times* been awarded the Army-Navy "E" for their great production record.

The same skill and efficiency in meeting requirements for safe, efficient, portable power supply is again becoming available to private industry. The same quality of product and workmanship can again be offered to you.

Let our experienced engineers work with you in solving your portable power supply problems.

Write for Bulletin MC-106 and General Connector Catalog.

MINES EQUIPMENT COMPANY

4275 Clayton Avenue • St. Louis 10, Missouri

For Better Results... MILLERPAX journal box packing waste

The new, better, Millerpax is designed to eliminate waste grabs, waste wipes and rolling of the packing in high-speed train service. Several years of research contributed the qualities that make Millerpax superior to ordinary packing.

Production of Millerpax is actually three processes in one—

First, all grit, metal, wood, paper, etc., are thoroughly removed from the threads.

Then, the threads are subjected to an air-wash which effectively eliminates short ends and lint.

Finally, the threads are interwoven to produce an almost endless mass.

Millerpax is especially advantageous for use in passenger car, freight car and locomotive journal boxes. It is available in either all wool, all cotton, or any combination of the two packings. The thoroughness and care used in producing Millerpax has achieved outstanding results for it on one of the large railroads that has been using Millerpax for more than a year.

If your railroad wants journal box packing that will contribute to better railroad operation, specify MILLERPAX!

MILLERPAX--Registration applied for
Manufacturing Process--Patent Pending

MILLER WASTE MILLS, INC.
WINONA, MINNESOTA
NASH-FINCH CO., Minneapolis · Exclusive Railroad Sales Representative

---

Salvage Defective Castings by the New Mogul

Mogul Quench-Arc-Weld Machine

Process and Equipment PATENTED

.DOT-WELD PROCESS

THE CLOSEST APPROACH TO A COLD WELD

Reclaim defective ferrous and non-ferrous castings without fear of setting up residual stresses, or crystallization. It affords a fast fill-in of aluminum, nickel, bronze or zinc which can be applied to any metal and is readily machineable. Dot-Welding is also being used for press fit work, local nickel clad to eliminate corrosion and other applications.

DOT-WELDING UTILIZES the new Mogul Quench-Arc-Weld Machine, a high amperage, low voltage unit, and the Dot-Weld Pistol. This combination affords a depth of penetration up to 1/32". The air pressure unit of the pistol quenches the arc in a constant stream of air.

Write for New Bulletin.

METALLIZING COMPANY OF AMERICA
INDUSTRIAL DIVISION
1330 Congress Street, Chicago 7 135 Cedar Street, New York 6

Something *NEW* in Better Pipe Cutting

New Efficiency-Balanced RIDGID CUTTER

with fast-action, thin-blade cutter wheel

● The instant you pick up this new RIDGID pipe cutter, with its rugged new style malleable frame, you like the feel of it, the efficient balance—and it cuts pipe with the easy speed that feeling suggests. True clean cuts, almost without burr, the thin tool-steel blade wheel rolling right through with least effort. Make your next cutter a new RIDGID—ask your Supply House. We're doing our best to keep it supplied.

You'll like this No. 42 4-wheel cutter, too — fast quarter turn cutting.

RIDGID
WORK-SAVER PIPE TOOLS
THE RIDGE TOOL COMPANY · ELYRIA, OHIO, U. S. A.

THOMAS *Metal Working* EQUIPMENT

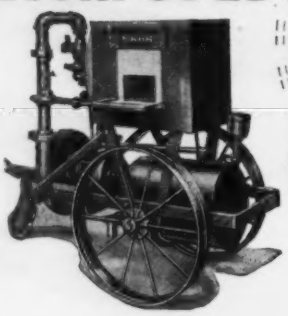
THOMAS MACHINE MANUFACTURING COMPANY

Angle Planers	Angle-Bending Machines
Angle-Beveling Machines	Spacing Tables Hand-Operated and Full Automatic
Multiple Punches	One Man Plate-Punching Tables
Single-End Punches	Special Machinery
Plate Shears	Contract Machine Work
Bar Shears	
Angle Shears	
Billet Shears	

Write for complete set of Bulletins 8

THOMAS
MACHINE MANUFACTURING COMPANY
PITTSBURGH (23), PA.

From COLD to DRIVING HOT in 4 minutes!



with
THE MAHR RIVET FORGE

The MAHR Triple Atomizing Burner is the secret of the fast and efficient heating performance of MAHR Rivet Forges. It gives a steady, soaking heat that is clean and smokeless—no oil drip or carbon deposit.

Here's economy, too! The power cost for compressed air is about *5 times greater* than for low-pressure fan or blower air used by MAHR Rivet Forges. With low pressure air, the fire brick lasts from 33⅓% to 50% longer.

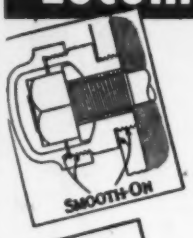
ASK FOR BULLETIN 175

on MAHR gas or Oil Fired Rivet Heaters, or bulletins on smithing forges, locomotive fire lighters, tire heaters, stress relief furnaces, flue annealing furnaces.

Sales Offices in Principal Cities

MAHR MANUFACTURING CO.
Division of Diamond Iron Works, Inc.
1710 NORTH SECOND STREET,
MINNEAPOLIS 11, MINN.

Here's Real Help for Locomotive Mechanics



The safe, speedy, effective way to stop leaks around seams, rivets, bolts, etc.; to tighten loose pipe connections; seal cracks and fill in cavities and pits in castings; pack stoker wings; plug cylinder seams; repair leaky water legs and tender tanks—use Smooth-On No. 1 Iron Repair Cement.

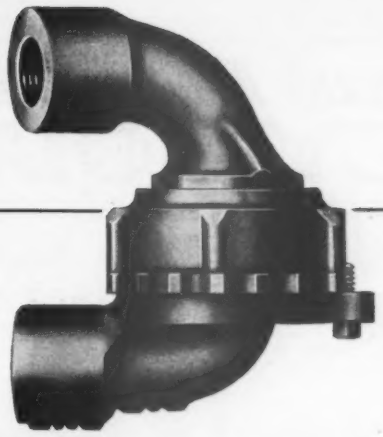
Easy to use—no heat, usually no dismantling required. Applied like putty. Expands slightly as it sets, insuring tightness. Hardens like metal—lasts like metal. Used for the past half century by engineers, mechanics, maintenance men. Get it at your supply house. 1-, 5-, 25- and 100-lb. sizes. If they haven't Smooth-On apply to us direct.

FREE Handbook of Repair Ideas

40 pages. 170 diagrams. Clear-cut, tested directions for well over 100 metal repairs for shop and home. Conveniently indexed. Pocket size—should be in every shop man's pocket. Send postcard for your copy.

Smooth-On Mfg. Co., Dept. 32
570 Communipaw Ave., Jersey City 4, N. J.

Do it with **SMOOTH-ON**



FLEXO JOINTS

make pipe flexible with the safety of rigid fittings

FLEXO JOINTS are used wherever a flexible or swing pipe joint is required to convey steam, compressed air, water, oil or other fluids through pipe lines that are moved or swung in different directions. They are also used to supply machinery or equipment with any fluid while in motion.

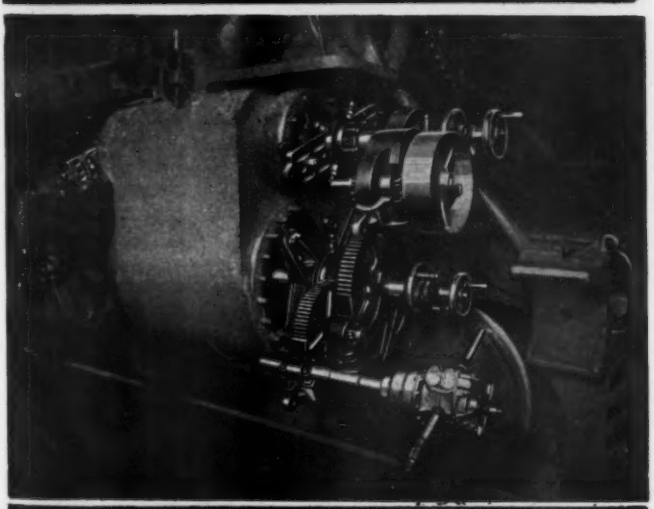
FLEXO JOINTS are reasonable in first cost, have long life and their maintenance cost is negligible. They are really trouble proof; just 4 simple parts — no springs, delicate parts or ground surfaces. Pipe sizes from ¼ inch to 3 inches; all pressures up to 1350 lbs superheated steam.

FLEXO

Write for Bulletin #166

FLEXO SUPPLY COMPANY, Inc.
4223 Olive Str. St. Louis (8) Mo.
In Canada
S. A. Armstrong, Ltd.
115 Dupont Str. Toronto (5) Ont.

PORTABLE BORING BARS for Railroad Shops



H. B. Underwood Corp.
1025 Hamilton Street
Philadelphia 23 Pennsylvania

George Smith, the man that designed the Smith Piston Parter, the Smith Locomotive Pinch Bar and Slipping Bar, Cable Grips, Plate Grips, etc., now has a darn good Tire Parter, for trucks and pleasure cars.

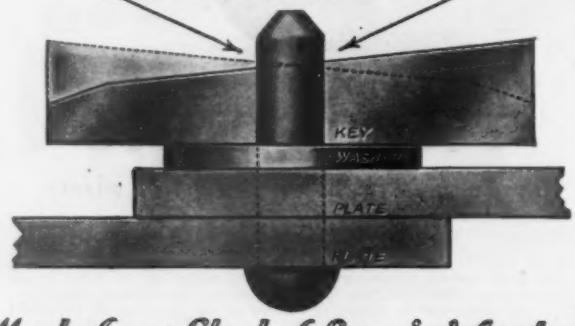
For the family, he has high chairs, walkers, diaper changers, Auto Observation Seats, and other things that might interest you.

Also, old George Smith is training the blind and crippled veterans so they can go in business for themselves, instead of depending on a day's salary.

If you want to know more about it, drop George a line.

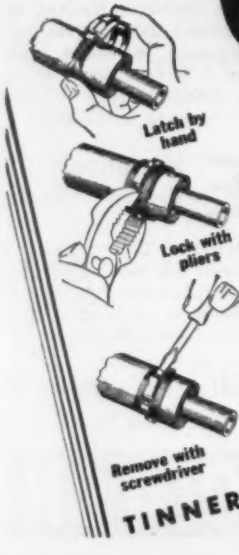
SMITH DEVICES
331 N. 4th St., Philadelphia 6, Pa.

-New Process-
KEY BOLTS
FOR "FITTING-UP" PURPOSES
No Instructions Needed
DRIVE KEY FROM EITHER SIDE
DOUBLE ANGLE IN KEY SLOT



Made from Steel of Special Analysis
— Hold Tighter —
— Last Longer —
— Cost Less —
McKAIG-HATCH INC.
MANUFACTURER
BUFFALO 7, N. Y.—U. S. A.

THE New TINNERMAN HOSE CLAMP



This one-piece, ratchet type Hose Clamp is easily latched by hand, then quickly locked with pliers. Removed by prying locking tongue out of ratchet teeth with screwdriver. It weighs less, has a lower profile, exerts uniform pressure, and may be used over and over again. Approved by Army and Navy Air Forces. Sizes from ½" O.D. up. Write for details.

TINNERMAN PRODUCTS, INC.
2029 Fulton Road, Cleveland 13, Ohio

Rugged . . . Efficient . . .
Safety Approved
JUSTRITE

Justrite Safety Lanterns and Flashlights are tops everywhere for these safety approved portable electric lights have what it takes for rugged work.

Take, for example, the All-Purpose Safety Lantern shown here . . . it's the finest portable light on the market and safe on many hazardous locations.

Justrite All-Purpose Safety Lantern

The lantern that's built of the finest materials. Twin-Bulbs for dependable light service. Has "kick-out" bulb sockets that immediately eject broken bulbs, breaking the circuit in the socket. A fixed guard protects the face of the lantern plus a movable guard-base and adjustable handle for convenience in focusing the light at any angle. Guards are sparkproofed for safety.

Listed for Safety . . . Justrite

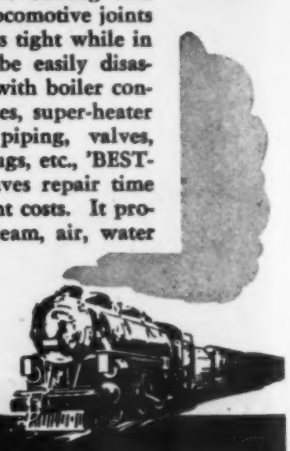
Listed by Underwriters' Laboratories, Inc. for safety in Class I, Group D. Locations by U. S. Bureau of Mines (Approval 1017) for safe use in methane gas and air mixtures and by the Bureau of Marine Inspection for safety in pump rooms of tankers . . . Justrite.

Ask your supplier about Justrite Safety Products

JUSTRITE MANUFACTURING COMPANY
2063 N. Southport Ave., Dept. D-8, Chicago 14, Ill.

IN LOCOMOTIVE CONSTRUCTION and MAINTENANCE
'BESTOLIFE
- INCREASES EQUIPMENT EFFICIENCY
- SAVES REPAIR TIME HOURS
- REDUCES NUMBER OF REPLACEMENT PARTS

'BESTOLIFE Lead Seal Joint Sealing and Anti-Seize Compound keeps locomotive joints sealed, and studs and staybolts tight while in service, yet allows them to be easily disassembled when desired. Used with boiler connections, fireboxes, smokeboxes, super-heater units, steam and exhaust piping, valves, pumps, injectors, washout plugs, etc., 'BESTOLIFE increases efficiency, saves repair time hours and reduces replacement costs. It provides leak-proof joints on steam, air, water and oil lines. Applied easily with a brush and does not deteriorate.



Manufactured Exclusively by

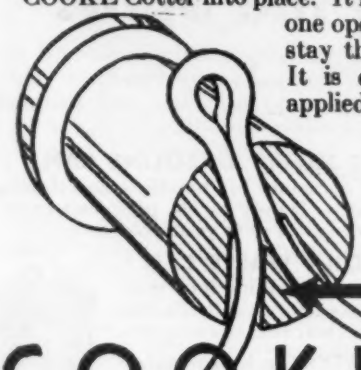
I. H. GRANCELL
1601 EAST NADEAU STREET
LOS ANGELES 1, CALIFORNIA

Greater SAFETY For a Lower Cost

WHY take chances with ordinary cotters—especially since the speeds of all trains have been increased?

Every application on a car, locomotive or any other moving vehicle can be made in absolute safety with the COOKE Pin and Cotter.

A couple of taps with a hammer drives the COOKE Cotter into place. It is securely locked in one operation—and it will stay there until removed. It is easily and quickly applied. You save time, money and promote maximum safety.



Note: This wedge opens, spreads and locks the cotter, thereby eliminating vibration and wear.

COOKE PIN and COTTER

"SELF OPENING—SELF LOCKING"

American Railway Products Co.
162 Post Road, Darien, Conn.

JOHNSTON RIVET FORGES

Equipped with NON-CLOGGING Vacuum Oil Burners—no oil valve to clog. Produce properly heated rivets—save oil, air, time and maintenance cost. Write for Bulletin R-801.

Engineers & Manufacturers of Furnaces, Burners, Blowers, Forges, etc.

JOHNSTON MANUFACTURING COMPANY
2825 EAST HENNEPIN AVENUE · MINNEAPOLIS 13, MINNESOTA

ALLIGATOR
TRADE MARK REG U.S. PAT OFFICE
V-BELT FASTENERS
in Railway Service

● This fastener has established the open-end cross-woven fabric V-belt as a drive with many advantages over both flat belts and endless V-belts for many railway services. The exclusive separable hinge joint of Alligator V-belt Fasteners saves time and makes it possible to quickly and easily install or remove the V-belts.

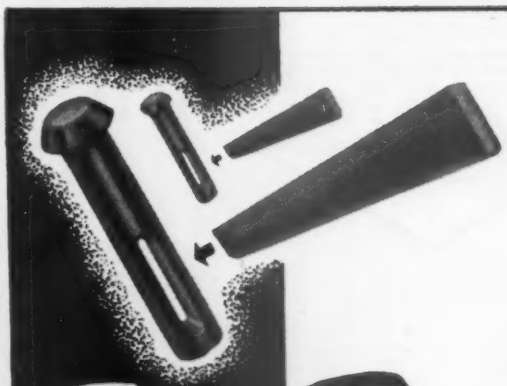
The fasteners are available in B, C, D and 1" sizes; also a 2" fastener for use on both lug and solid type V-belts.

Many roads are now using Alligator V-belt Fasteners. If you are not familiar with this latest development in V-belt fastening you should write for Bulletin V-205.

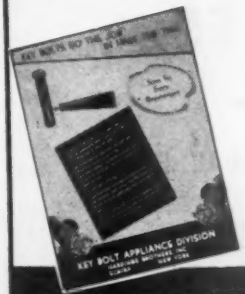
Order from your supply house

FLEXIBLE STEEL LACING CO.
4694 Lexington St., Chicago 44, Illinois

Also sole manufacturers of Alligator Steel Belt Lacing for flat transmission belts and Flexco HD Belt Fasteners and Rip Plates for fastening and repairing conveyor belts.



Fast Riveting



Riveters drive twice as many rivets – no nuts to unscrew. A blow of the hammer removes the key.

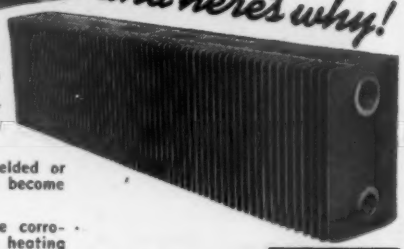
KEY BOLT APPLIANCE DIVISION
HARDINGE BROTHERS, INC., ELMIRA, N.Y.

INSTALL

GRID UNIT HEATERS

THAT WILL STAND SMOKE FUMES FROM ENGINES BEING FIRED-UP IN THE ROUNDHOUSE

and here's why!



- One piece construction heating sections (patented) of high test cast iron that withstand steam pressure up to 250 lbs.
- No soldered, brazed, welded or expanded connections to become loose or develop leaks.
- No electrolysis to cause corrosion, breakdown, leaks, or heating failures.

HIGH TEST CAST IRON HEATING SECTIONS

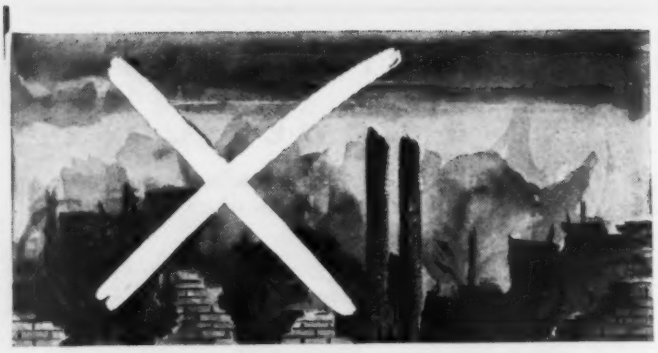
As one midwest railroad reports, "GRID Unit Heaters have been in our roundhouses for 8 years, without maintenance. They withstand sulphuric fumes from engines being fired up." It's the material that makes the difference. Complete data upon request.

SEND

Now for this new booklet "Corrosion in Unit Heaters"—free upon request.

D. J. MURRAY MANUFACTURING CO.

Wausau, Wisconsin



Marks the Spot!

Careless fires can be practically eliminated by the proper installation of Justrite Safety Products. They provide maximum protection for men and railroad equipment . . . and at a minimum cost.

JUSTRITE SAFETY GASOLINE CAN

The approved container for handling and storing flammable liquids. Handy to fill, pour and carry. Ruggedly built in sizes to fit your every need.

JUSTRITE OILY WASTE CAN

Furnished with or without foot lever opener. Top closes automatically. Built to smother waste material fires before they're started.

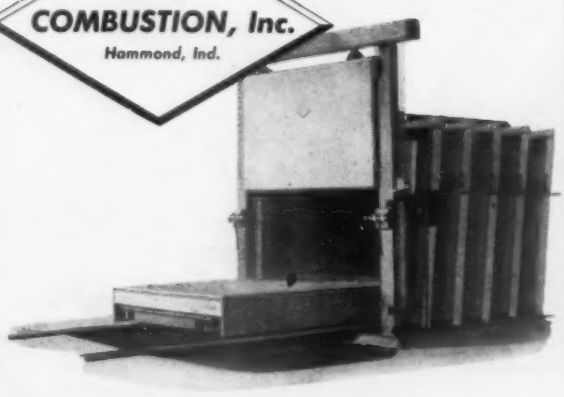
APPROVED FOR SAFETY The Justrite Safety Gasoline Can and the Oily Waste Can are approved for safety by Underwriters' Laboratories, Inc. and the Associated Factory Mutual Fire Insurance Companies. Ask your Supplier about Justrite Safety Products.

They're standard equipment on many railroads.

JUSTRITE MANUFACTURING COMPANY

2063 N. Southport Ave., Dept. D-8, Chicago 14, Illinois

JET COMBUSTION, Inc.
Hammond, Ind.



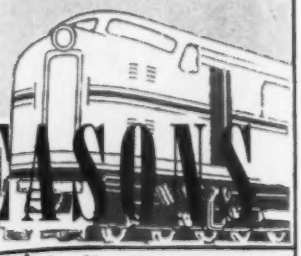
SIDE FRAMES BOLSTERS—

OUR FURNACES IDEAL FOR
ANNEALING
NORMALIZING
STRESS RELIEVING

JET COMBUSTION, INC.

404 LLOYD BLDG. HAMMOND, INDIANA

4 REASONS



why Jones-Speed Indicators are preferred by leading Railroads

- Easily installed. Both fixed and portable type available.
- Centrifugal type. (No magnets) Lightweight ball-bearing mechanism assures long life.
- Accuracy assured by rigid inspection and calibration.
- Low initial cost.

Jones Speed Indicators are used by such leading Railroads as the Pennsylvania, New York Central, N. Y., N. H. & Hartford, Southern Railway, and others. Our engineering staff will convert any model to meet special requirements. Write for catalog and specifications.

JONES MOTROLA SALES CORP.

434 Fairfield Ave., Stamford, Conn.

KIENE DIESEL INDICATOR

for

QUICK AND ACCURATE TESTING OF COMPRESSION AND FIRING PRESSURES ON DIESEL SWITCHERS AND ROAD LOCOMOTIVES

- **No Pistons — No Springs — No Synchronizations — Only One Moving Part**
- **Simple and Rugged Construction**
- **Easy to Use — No Experience Necessary**
- **Compact — Light in Weight — Low in Cost**

Write for descriptive bulletin

KIENE DIESEL ACCESSORIES, INC.
380 LEXINGTON AVE., NEW YORK 17, N. Y.
Factory and General Offices:
5334 AINSLIE STREET, CHICAGO 30, ILL.

Serving RAILROADS
and
Car and Locomotive Builders
OVER 30 YEARS

"NEW PROCESS"

PUNCHES
DIES
RIVET SETS

Made from tough high grade, wear resistant ALLOY Tool Steel to assure longer service life.

GEO. F. MARCHANT CO.
1430 S. ROCKWELL ST., CHICAGO, 8 ILL.

KING LUBRICATOR
Model No. 36
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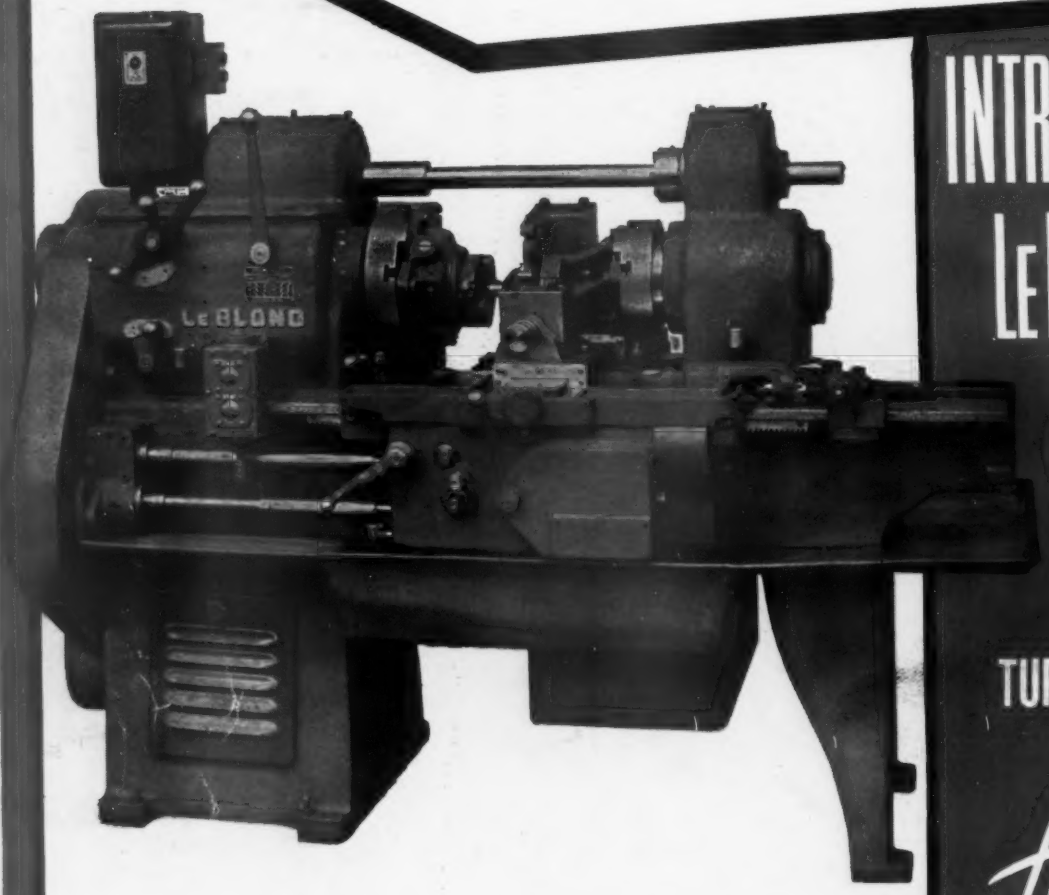

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